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SECOND MEETING OF THE INTERNATIONAL ASTRONOMICAL UNION HELD IN ROME, MAY 2-10, 1922.*

By OLIVER J. LEE.

This association of the astronomers of many countries is so definitely the spiritual successor to the International Union for Co-operation in Solar Research that a word about the latter organization may be of interest. George Ellery Hale, famous for his individual discoveries, has from the first of his career realized the importance of co-operation. It was through his activity that the Solar Union, as it came to be called for convenience, was organized at the Scientific Congress held in connection with the St. Louis Exposition in 1904-5. It is interesting in view of recent events to note that of 17 societies and academies, 14 foreign, which were invited by a committee of the American National Academy of Sciences to take a part in this organization, all accepted save two—the Prussian Academy of Sciences declined, and the Astronomische Gesellschaft did not answer the invitation. German participation was, however, assured through the German Physical Society, which accepted the first invitation although no representative was present at the St. Louis meeting. The second conference of the Solar Union took place at Oxford in 1905, the third at Meudon near Paris in 1907, the fourth at Mount Wilson in 1910, the fifth at Bonn in 1913. The sixth meeting was set for Rome in 1916 but, naturally, it was not held. At the Bonn meeting in 1913 German astronomers appear for the first time as representatives of the Royal Academy of Science of Berlin, although individual Germans had attended the third and fourth meetings as well.

Before the war broke out the Solar Union had become a powerful instrument for unifying and amplifying the work of solar physicists and spectroscopists all over the world. The momentum gained by the Solar Union lost its force in the war, but the experiences of benefit and pleasure derived from it in the past were no doubt still fresh in the minds of "the American delegation to the conference of the Inter-allied Academies held in London in October 1918, when it proposed that the existing organizations relating internationally to one and the same subject, to astronomy for example, should be succeeded by a single society so formulated as to serve the purposes of all the associations from which they should withdraw. The suggestion was approved by the conference. At a later meeting in Paris it was decided

*The photographs, reproductions of which accompany this article, were kindly sent us by Pio Emanuelli of the Vatican Observatory.

that representatives of astronomy in the allied and associated nations should meet in Brussels in July 1919, to create the International Astronomical Union."

"The American Section of this Union was organized under the auspices of the National Research Council" and the following delegates went to Brussels: W. W. Campbell, *Chairman*, W. S. Adams, Benjamin Boss, Philip Fox, S. A. Mitchell, Charles E. St. John, F. H. Seares, Frank Schlesinger and Joel Stebbins, *Secretary*. Thirty-three astronomical delegates were present, 8 from Belgium, 8 from Great Britain, 7 from France, 1 from Italy, and 9 from the United States of America.

After much conference and study it was decided to name 32 working committees which should include most of those astronomers who are active in any special branches of astronomy. Each committee was given power to coöpt into its membership additional persons by a two-thirds vote. "The constitution provides that all committees shall automatically go out of existence at the end of each triennial meeting of the Union. This offers the opportunity for reorganization upon the basis of those who work."

The officers chosen for the first period of three years were: *President*, Benjamin Baillaud, Director of the Paris Observatory. *General Secretary*, Alfred Fowler, Professor of Astrophysics, Imperial College of Science and Technology, South Kensington, London. *Vice Presidents*, W. W. Campbell, Director of the Lick Observatory; Sir Frank Dyson, Astronomer Royal, Greenwich, England; Georges Lecointe, Director of the Royal Observatory of Belgium, Brussels; Annibale Ricco, Director of the Observatory of Mt. Etna, Sicily. These officers constitute the executive committee of the Union.

It was the plan to have the members of each of the committees work along individually as before upon their special problems, but establishing a rather close family connection with the others as time goes on and finally to prepare a committee report for the next general meeting of all the committees where stock of progress is taken and plans for the future are agreed upon, especially in the matter of linking together the activities which will react upon each other most effectively.

During the past three years there has been much wholesome intercourse in the various committees. Many members have been helped materially in formulating the plans and policies of their own work. Many of the committees have added to their membership. Every incentive to creative work on the part of the individual remains and the Union has definitely emphasized the synthetic element in our scientific endeavors, which we recognize as of the highest importance.

Naturally the national sections act more or less as units. Thus the American Section met in Washington for two days of conference, before the delegates sailed for Rome, to discuss and adopt the reports

of the committees. This meeting, under the chairmanship of Dr. Schlesinger, was attended by all astronomers who could conveniently be present. Fully 20, besides delegates, took part in this conference.

In the evening of April 3, the delegates to Rome and a number of other astronomers and geophysicists were entertained most pleasantly at the Naval Observatory as the guests of the Superintendent, Captain W. D. MacDougal and Mrs. MacDougal.

The American astronomers who went to Rome were:

Frank Schlesinger, *Chairman*	John A. Miller
Robert G. Aitken	Henry N. Russell
Heber D. Curtis	F. L. Seares
Oliver J. Lee	Harlow Shapley
Frank B. Littell	Charles E. St. John

The ladies in the party were Mesdames Aitken, Lee, Littell, Miller, Russell, Shapley.

Individualism with emphasis marked the mode of travel of our people. Several had left before the Washington meeting, several travelled alone. The largest single party was that composed of 7, who went together on the Fabre Line SS Canada, sailing from New York on April 6.

The geographical dispersion experienced by the American delegates was from Longitude 118 degrees West to 35 degrees East and from latitude North 32 degrees to North 61 degrees. This seems a fairly wide range of motion, but when compared to the travelling habits of our Australian and Japanese friends it looks almost as if we had really stayed at home.

Various reports were heard of adventures abroad. One small party coöpted the captain of their vessel for a trip to Jerusalem to insure against the departure of the ship before their return.

Not very long after the visit by a small group of our people to those parts, trouble broke out between the Greeks and the Turks. Since, however, it seems certain that their difficulty is not about the quantum theory in the spectral classification of stars, it is possible that our friends may prove their innocence in the matter. One member is reported to have paid only $1.50 for his passage to France. However, he by chance lost some money out of his pocket, while in Rome, so that we did not feel quite so envious of his privileges as an officer in the Navy, as we might otherwise have done.

Those of us who sailed on the SS Canada on April 6 had, before landing in Naples on the 21st, gotten a splendid view of the volcanic Azores, the citadel, Gibraltar, and had mixed for more than a day with the handsome Arab chieftains from the deserts who had come to Algiers to pay their respects to President Millerand of France on the occasion of his visit to that part of the Republic.

The English came down in a party under the arrangements of Thos. Cook and Son, 23 strong, with Mr. Parr, an accomplished Italiophile, as a supplementary guide—the English were more circumspect than

we Americans. The ladies in their party were Lady Lockyer, Mrs. W. J. S. Lockyer, Mrs. Fowler, Mrs. Newbegin and Mrs. Dodwell of Australia. Among the French who were present besides President Baillaud were Dr. and Mrs. Jules Baillaud from the Paris Observatory. One or several representatives were present from each of the follow-

1. P. Emanuelli. 2. K. Nakamura. 3. G. Bigourdan. 4. G. Armellini. 5. G. Boni. 6. Ch. Lallemand. 7. A. Anile.

ing countries: Argentine, Australia, Belgium, Brazil, Canada, Czecho-Slovakia, Denmark, Egypt, England, France, Holland, Italy, Japan, Mexico, Norway, Poland, Scotland, South Africa, Spain, Sweden, and the United States.

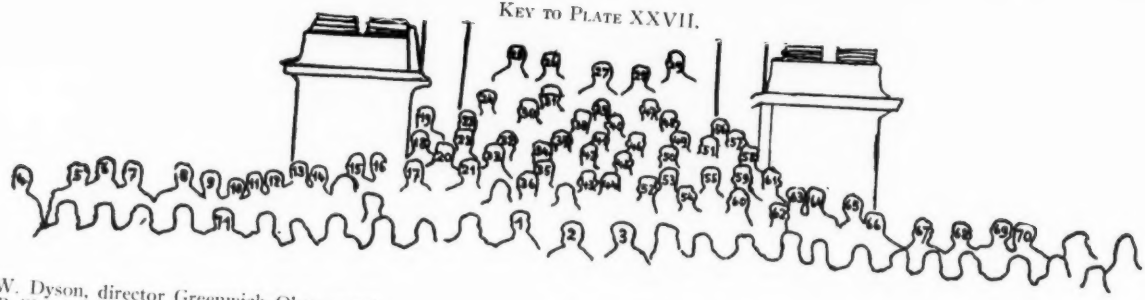
At Rome the Italian Committee on Arrangements, headed by Senator Vito Volterra, the mathematician, had taken good care to provide for a number of social events of both formal and informal nature. Although one large hotel had been designated as the center for the visiting scientists, they were soon scattered in pensions and hotels all over the newer part of the city.

The opening exercises in the Campidoglio or State House came first. To this meeting were invited not only the astronomers but also the members of the Geophysical Union, which held its triennial congress in the city at the same time. Speeches were read by the Mayor of Rome, by the Minister of Education, and by the presidents of the two unions. King Victor Immanuel and the Crown Prince sat in the front seat and by their side a prince—cardinal with his red cap representing the Holy Father, Pope Pius XI. We were told that this wa the first time since 1870 that a papal representative had appeared in

PLATE XXVII.

PHOTOGRAPH TAKEN AT THE CORTILE DI S. DAMASO AT THE VATICAN, ROME, MAY 10, 1922.

KEY TO PLATE XXVII.



1.—F. W. Dyson, director Greenwich Observatory.
2.—B. Baillaud, director Paris Observatory.
3.—V. Cerulli, vice president of the Astronomical Council.
5.—Col. E. E. Marwick, British Astronomical Association.
6.—E. Hertzsprung, Leiden (Holland) Observatory.
7.—A. M. Newbegin, British Astronomical Association.
8.—W. Bowie, director of Geodetic Service(Washington).
9.—P. Ditisheim, Paris.
10.—G. Platania, Catania Observatory.
12.—R. A. Shaw, British Astronomical Association.
13.—J. N. Baldwin, Melbourne Observatory.
14.—Rev. Th. E. R. Phillips, British Astronomical Association.
15.—R. A. Sampson, director Edinburgh Observatory.
16.—G. F. Dodwell, Government Astronomer of South Australia.
18.—L. F. Murguia, Mexico Weather Bureau.
19.—H. H. Kimball, Washington Weather Bureau.
20.—H. Philippot, Observatory in Uccle (Bruxelles).
21.—J. Gallo, director Tacubaya (Mexico) Observatory.
22.—E. F. Pigot, director Riverview (Sydney) Observatory.
23.—G. Perrier, chef de la Section de Geodesie (Paris).
24.—Ing. Dorè, Firenze, Italy.
25.—A. D. C. Crommelin, Greenwich Observatory.
27.—G. Bigourdan, Paris Observatory.
28.—J. Baillaud, Paris Observatory.
30.—J. C. Conde, director of Spain's Meteorological Service.
31.—S. P. Boskovic (Czecho-Slovakia).
33.—H. N. Russell, director Princeton University Observatory.
34.—Banochiewicz, of the Observatory in Cracovie.
36.—G. B. Rizzo, Messina University.
39.—Littlehales, U. S. Naval Observatory.
40.—C. Somigliana, Turin University.
44.—C. E. St. John, Mount Wilson Observatory.
45.—J. Jaumotte, director Meteorological Institute at Uccle (Bruxelles).
46.—H. Vanderlinden, Uccle (Bruxelles) Observatory.
47.—F. Vercelli, director Trieste Observatory.
48.—Col. Norrel, Service geogr. de l'Armie, Paris.
49.—J. Galbis, director Spanish Meteorological Service.
50.—L. Rodes, director Ebro (Tortosa) Observatory.
51.—H. Deslandres, director Meudon (Paris) Observatory.
52.—G. Abetti, Arcetri (Florence) Observatory.
53.—L. Volta, Milan Observatory.
54.—E. Bianchi, director Milan Observatory.
55.—P. Emanuelli, Vatican Observatory.
56.—J. Krassowski, Universite de Pologne, Varsavie.
57.—G. Ferrié, membre de l'Institut (Paris).
58.—A. de La Baume Pluvinel, membre du Bureau des Longitudes.
59.—A. Di Legge, director Capitol (Rome) Observatory.
60.—G. Armellini, Pisa University.
61.—O. J. Lee, Yerkes Observatory.
64.—F. Bowers Littell, U. S. Naval Observatory.
65.—J. Bosler, Meudon Observatory.
66.—Col. G. Ferri, Italian Military Geographical Institute (Florence).
67.—Col. C. Bardeloni, Italian Military Wireless Service (Rome).
68.—Delcambre, directeur du Bureau National Meteorologique (Paris).
69.—H. D. Curtis, director Allegheny Observatory (U. S. A.)
71.—L. A. Bauer, director Department of Terrestrial Magnetism, Carnegie Institute, Washington.

the Campidoglio and this event taken with many others indicates a rapproachment, or "getting together" as we would say, of the Church and the Roman State. All the speeches, except that of President Baillaud, were in Italian so that most of us had ample time to study the mural decorations of the fine hall, depicting events from early Roman history, and to admire the gorgeous uniforms and powdered heads of the statehouse guards. The Campidoglio, as we had opportunity to find out a few evenings later, is an old palace filled with works of art and historical relics. Great tapestries, large and small paintings cover every available wall, room upon room and corridor upon corridor, while in display cases all over, could be seen antiquities ranging from

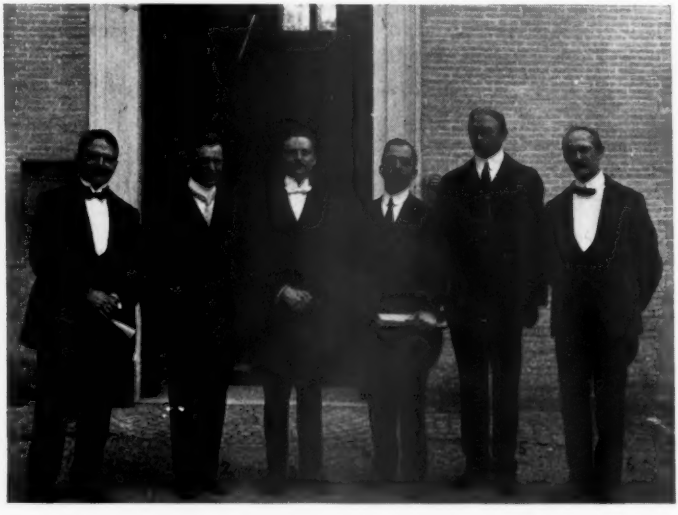
1. H. H. Turner. 2. L. Rodès.

the mummified remains of early Romans to the gems and jewels with which they decorated themselves when alive. Italians seem to have had this for a motto, "Count any space on a wall waste space unless thou canst paint a picture or portrait or group thereon." Of necessity many of these must be bad or even grotesque, but masterpieces occur frequently enough to make the independent search for them a fascinating pastime.

Outside the Campidoglio, on the terrace, a gaunt wolf and a pair of eagles are kept in cages, presumably to remind citizens of their vigor-

ous beginnings as a state.

During one of the first evenings of our stay in Rome a brilliant reception was given by city and state officials in the Campidoglio. One afternoon the ladies of the committee on arrangements gave a tea in the halls of the Accademia dei Lincei where the sessions of the two congresses were held. On another afternoon we were shown through the Palatine Gardens by expert archaeologists and were given a reception by the Ministry of Public Instruction. In each of these cases the refreshments were quite elaborate. The reader will be interested to



1. G. Ferri. 2. G. F. Dodwell. 3. P. Emanuelli. 4. C. Bardeloni. 5. H. N. Russell. 6. F. B. Littell.

know what attitude was taken by the American members when confronted with the array of wines which has made Italy famous. The remark by an experienced observer, not of our group, will be appreciated when he says,

"Overjoyed were we to find
That though on prohibition bent
They've kept an open mind."

The old Palazzo Corsini, on the northwest banks of the Tiber, is the home of the Accademia dei Lincei. This palace, like the Campidoglio, is of great size and is a gallery of art as well as the seat of the Academy. The astronomers had the second floor and the geophysicists the third.

English, French and Italian were used in the general sessions. Dr. Giorgio Abetti, Col. Stratton, Count de la Baume Pluvinel and Dr.

Seares were official secretaries and translators. These men won our constant admiration for their masterly abstracting and translations of speeches and remarks from one language to another. Many of the members were able to make their remarks in two languages and one, at least, our genial and gifted friend from Mexico, talked in three languages in succession with equal fluency. Everyone laughed when on one occasion we had heard a report in English, he got up and began commenting on it in French, indicating that accidentally he had been thinking in French while the English was spoken.

Most of the time of the congress was taken up by the conferences of the International Committees. Visiting of these meetings by members

H. Kimura Shaking Hands with the Italian Minister of Public Instruction, A. Anile.

of other committees was encouraged and was widely practised. Some of our members, who are polymaths, were almost attending two different meetings at the same time.

The general sessions were presided over by President Baillaud or in a few cases by one of the vice-presidents, Dyson, Cerulli acting for Ricco (deceased), Stroobant acting for Lecointe (absent), and Schlesinger acting for Campbell (absent).

Several changes were made in the list of committees. This is an indication that the Union is fluid rather than static in its tendencies. Therein, of course, lies the guarantee that it will long serve its purpose in a world where changing points of view is the daily order and where ability to make quick readjustments is a basic condition of life. The

Committee on Republication of Early Astronomical Works, the Committee on Astronomical Expeditions, Eclipses, etc., and the Committee on Reform of the Calendar were all dropped. Three committees, that on Solar Radiation, that on the Spectro-Helio-Enregistreur and that on the Solar Atmosphere were consolidated into one, the Committee on Solar Physics. The committees on Asteroids and on Comets were united as a Committee on Asteroids, Comets and Positional Work on

1. G. Armellini. 2. A. Anile. 3. P. Emanuelli. 4. F. W. Dyson.

Satellites. In this manner the number of International Committees was reduced from 32 to 26.

The invitation of the English astronomers to hold the next meeting of the Union at Cambridge in 1925 was accepted. On behalf of the Americans Dr. Schlesinger stated that we should look forward to having the Union meet in America in 1928.

The following officers were elected to serve for the next three years:

President, W. W. Campbell
General Sec., Alfred Fowler
Vice Presidents, Cerulli, De Sitter, Deslandres, Hirayama, and Hough.

Full reports of the various committees as finally adopted by the Union, as well as complete lists giving the memberships of these committees, will be published later as a Circular of the National Research Council. In view of this fact it is not thought necessary to give these technical details at this time.

PLATE XXVIII.

THE PALAZZO CORSINI IN ROME
containing the rooms of the R. Accademia dei Lincei where the International Congress of Astronomy, Geodetics and Geophysics held its sessions.

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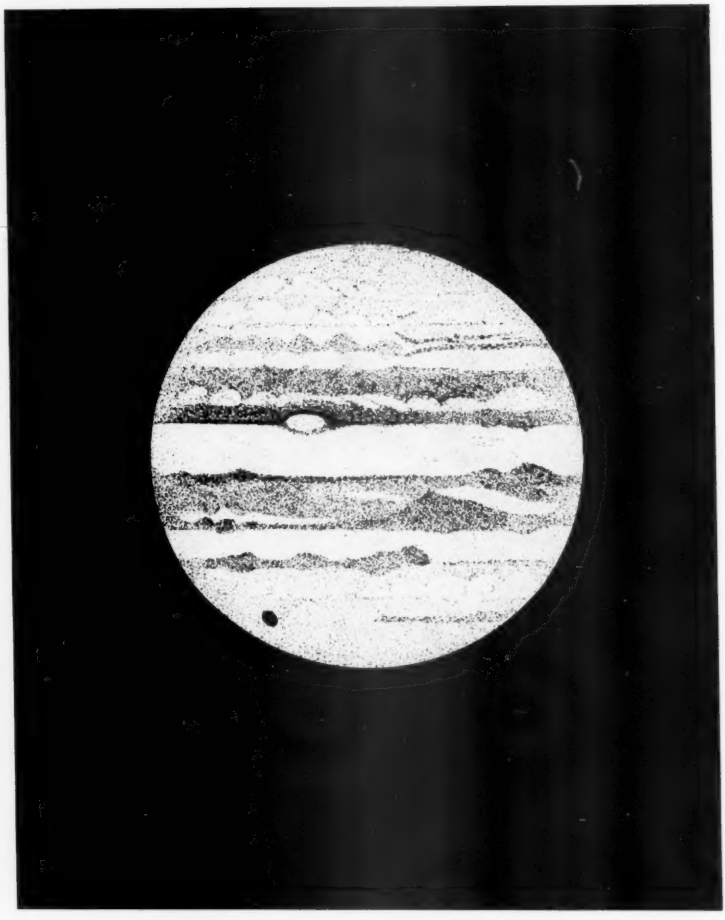


DRAWING OF JUPITER BY P. C. DANIELS

at the Drake University Municipal Observatory, Des Moines, Iowa, 1922, May $19^{d}\ 10^{h}\ 45^{m}$ C.S.T. The shadow of satellite II is seen in transit near the lower left edge of the disc.

After the conclusion of the meetings in Rome, many of the members of the Union went to Florence upon invitation of the various scientific institutions of that city. For one whole and very full day we were entertained by the Mayor of the City, who is the Director of the Physical Institute, the Military Geographical Institute, and our ever-present friend and guide Dr. Giorgio Abetti. At the Military Institute we were shown every stage in the process of making military maps, both on a plane and in relief. After a reception in the city hall we were taken in automobiles to the Galilean Museum and to the Observatory on Arcetri hill. At the Museum the mayor had the case containing Galileo's first telescope unlocked and we were permitted to handle and look through the actual telescope with which this pioneer first saw mountains on the moon, the satellites of Jupiter and Saturn's rings. I think each one of us experienced a unique thrill when we read with ease the calibrations on an ordinary thermometer 60 feet away with this light telescope made of paper tubes. At Arcetri the old observatory was inspected, as well as the foundations of the new tower telescope and the physical laboratories of the university. Near-by still stands, in good preservation, the house where Galileo lived for some time and where he died. Across a small ravine is the convent where his daughter lived and died as a nun. A little farther away stands an old house in which Savonarola lived for some time. The view across the busy city to the calm wooded heights of Fiesole cannot easily be forgotten.

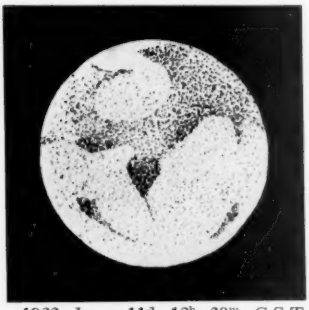
The greatest appreciation was voiced on every hand among the visiting delegates of the thoughtful arrangements and the entertainment provided for them by the committees both at Rome and at Florence.

DRAWINGS OF MARS AND JUPITER.

By D. W. MOREHOUSE.

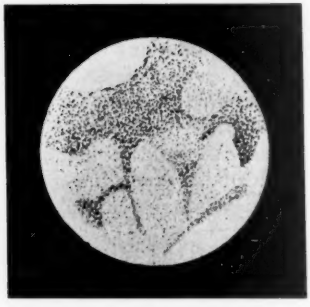
The accompanying drawings of Mars were made at the Drake University Municipal Observatory during the 1922 opposition. In the new location in Waveland Park, a grassy plot of about 190 acres, the seeing has been unusually good at times and this fact coupled with the ability of Parmelee Daniels to draw what he sees has resulted in the most satisfactory study of Mars which we have been able to make at Drake University.

Mr. Daniels has been with the department for two years and has had considerable training in sketch making. He is ambidextrous, drawing or writing equally well with either hand. His sense of proportion seems to be very keen and with deep interest and wholesome

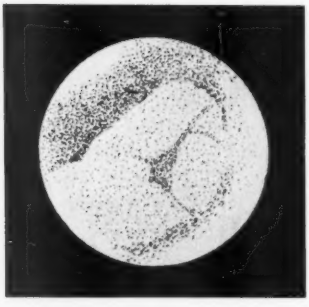


1922 June 11^d 12^h 30^m C.S.T.
Seeing 6

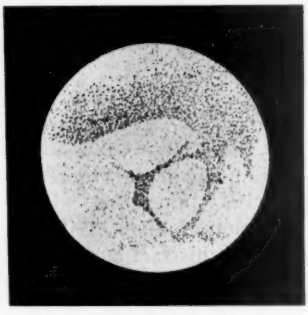
1922 June 13^d 13^h 00^m C.S.T.
Seeing 7



1922 June 16^d 12^h 00^m C.S.T.
Seeing 6



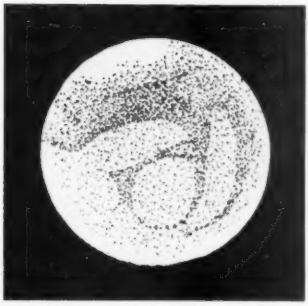
1922 June 19^d 10^h 20^m C.S.T.
Seeing 6



1922 June 19^d 11^h 20^m C.S.T.
Seeing 6

1922 June 20^d 11^h 30^m C.S.T.
Seeing 7

DRAWINGS OF MARS BY P. C. DANIELS
at the Drake University Municipal Observatory, Des Moines, Iowa.



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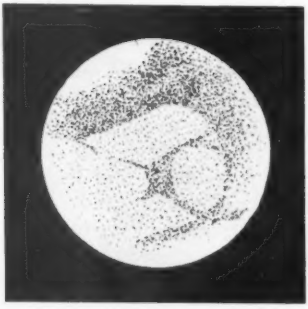
Seeing 6-7



1922 June 21d 12h 00m C.S.T.
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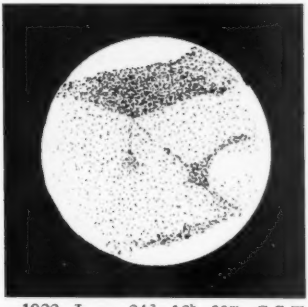

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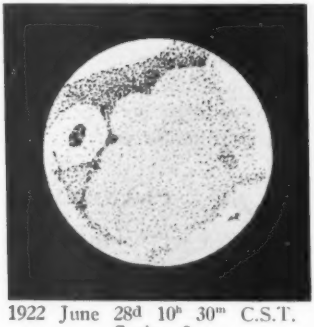

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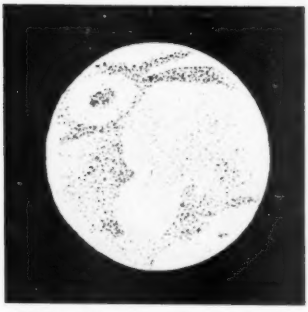
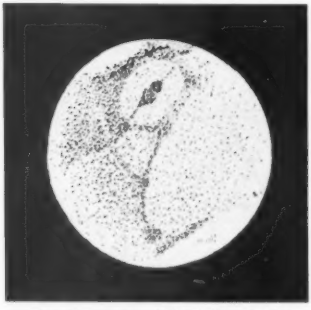


1922 July 1d 11h 05m C.S.T.
Seeing 3



1922 July 3d 10h 30m C.S.T.
Seeing 6

DRAWINGS OF MARS BY P. C. DANIELS
at the Drake University Municipal Observatory, Des Moines, Iowa.

enthusiasm, he has spent hours observing in preparation for this work. His notes follow:

NOTES ON MARS.

The sketches were made without study of maps or knowledge of the surface features of the planet. The drawings are ink copies of the original pencil sketches made at the telescope. The method of drawing was to make a long and careful study of the markings for thirty or forty-five minutes and then to make a quick sketch in two to four minutes, depending on the seeing and the details visible. The seeing was determined by turning to a near by star, usually Antares, and estimating it according to the standard scale. No markings were recorded that had not been seen at least three times.

The various powers used and the seeing accompany the drawings. No account has been taken of the slight variation in the angular diameter of Mars' disk.

NOTES ON JUPITER.

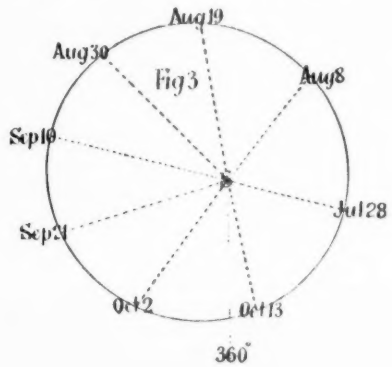
The night on which the original drawing of Jupiter was made, the seeing was ten on the standard scale. On a subsequent night the drawing was checked under the same conditions of seeing. A power of 360 was used both evenings. At three other observations, partial checks were made with the seeing ranging from seven to nine.

PLANETARY CONFIGURATIONS.

By FREDERIC R. HONEY.

MERCURY'S ORBIT—*Continued from page 222*

If the plot of an orbit be made on a large scale the projection on the ecliptic should be constructed by projecting, at the discretion of the draughtsman, either the major and minor axes, or a pair of conjugate diameters of the ellipse. In either case the projection is a pair of con-



jugate diameters, from which, by a simple construction, the major and minor axes of the projection may be found. This construction is employed in the case of the orbit of a planetoid, or of a periodic comet, which is inclined at a large angle to the ecliptic. If one of the axes of an ellipse is parallel to the ecliptic the construction is simplified. In this case the axes are *projected* in axes.

On account of the great variation of the planet's velocity in its orbit —due to the great eccentricity—Mercury's revolution around the sun illustrates very clearly the law by which *the line joining it to the sun sweeps over equal areas in equal intervals of time.* The period of revolution is divided into eight equal periods of eleven days, and Mercury's positions for one revolution between the dates July 28 and Oct. 24 are shown in Fig. 3. At the latter date the position very nearly coincides with that of July 28.

THE ORBIT OF VENUS

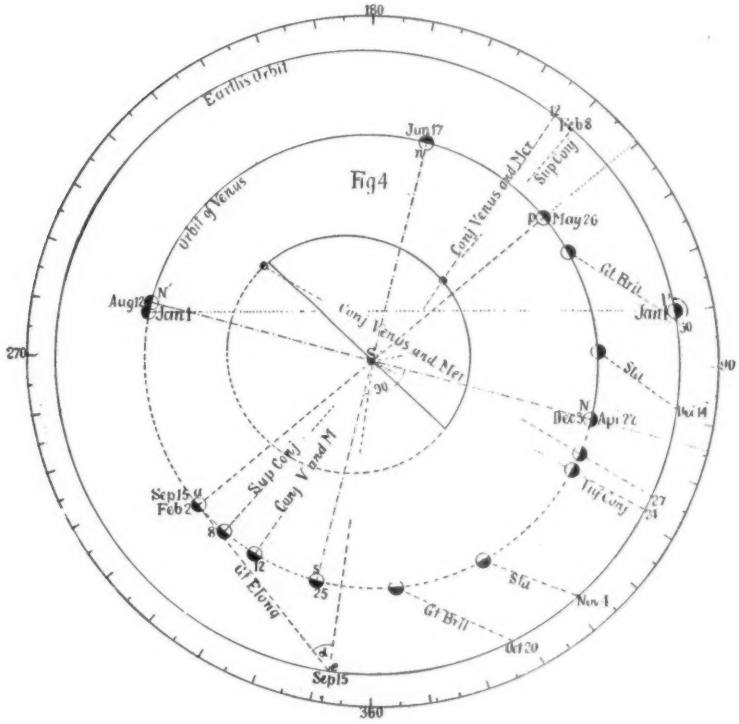


Fig. 4. The plane of the orbit of Venus is inclined to the ecliptic at an angle of 3°.4. The cosine of this angle is 0.9982. Therefore any

line of this plane which is perpendicular to the line of nodes is, in projection, diminished by less than one five-hundredth part of its length. That is to say, in a drawing of these dimensions, the projection is indistinguishable from the true form of the orbit. Moreover, since the eccentricity is very small (0.0068), the true form does not differ practically from a circle whose center is at a distance from the sun equal to the semi-major axis, or mean distance, multiplied by the eccentricity. This measurement is scarcely visible in the drawing. The major axis is drawn through the sun to the longitude of perihelion (130°.5); and the radius of the circle is 3.36 inches, which represents the mean distance of 67.2 million miles drawn to the same scale as that of the earth. The line of nodes, or the trace of the plane of the orbit is drawn through the sun to the longitude of the node (76° nearly).

The period of revolution is 224.7 days. The relative positions of the earth and Venus are shown for January 1; and since the earth rotates in the direction of the arrow, it is evident that Venus rises before the sun, that is to say, the planet is morning star at the beginning of the year. Venus is at aphelion *a* Feb. 2; and in superior conjunction with the sun Feb. 8. After this date Venus sets after the sun and is evening star until Nov. 24. On Feb. 12 the planet is in conjunction with Mercury.

A plane which is passed through the sun perpendicular to the ecliptic and to the line of nodes NN′, is intersected by the orbit at *s* and *n*—the former below, and the latter above the ecliptic. Venus is at *s*, the greatest heliocentric latitude south Feb. 25. The planet reaches the ascending node *N* Apr. 22. It makes the perihelion passage May 26; it is at the greatest heliocentric latitude north *n* June 17; and is at the descending node *N′* Aug. 12. Venus is at greatest elongation *a* Sept. 15, when very near aphelion, and is at a maximum apparent distance from the sun this year. Since the line *ea* joining the earth with Venus is inclined at a small angle to the ecliptic, and the earth's radius vector *Se* is represented in its true length, the projection of the angle *a* between these lines differs a very little from the true value of the angle subtended by Venus' radius vector on Sept. 15. The student will recognize an elementary problem in descriptive geometry *to find the true value of an angle between two given lines eS and ea.*

Greatest elongation is followed by greatest brilliancy Oct. 20; stationary Nov. 4; inferior conjunction Nov. 24; stationary Dec. 14; greatest brilliancy Dec. 30; and greatest elongation in 1923. Venus is in conjunction with Mercury Nov. 27 when both planets are very near the ecliptic.

The apparent diameter of a heavenly body is inversely proportional to its distance from the earth. Some of the phases and the great variation in the apparent diameter of Venus are shown in Fig. 5. On Feb. 8, if the sun were out of the way, the diameter would be represented in

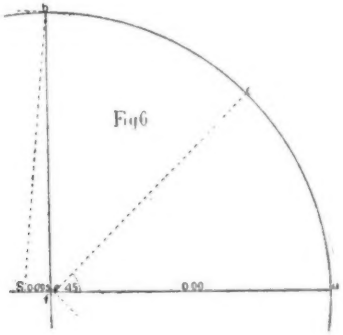
Fig 5

Feb 8 Sep 15 Oct 20 Nov 4 Nov 24

the dotted circle. On Sept. 15 one half of the illuminated surface is visible. As the planet approaches the earth its apparent diameter increases rapidly, but less of the illuminated area is visible. After Sept. 15 Venus shows the beautiful crescent phase, and the illuminated area diminishes until the date of inferior conjunction when, if the planet were visible, the diameter would be represented in a circle about six and a half times the diameter of that which would represent it at the date of superior conjunction.

The Orbit of Mars.

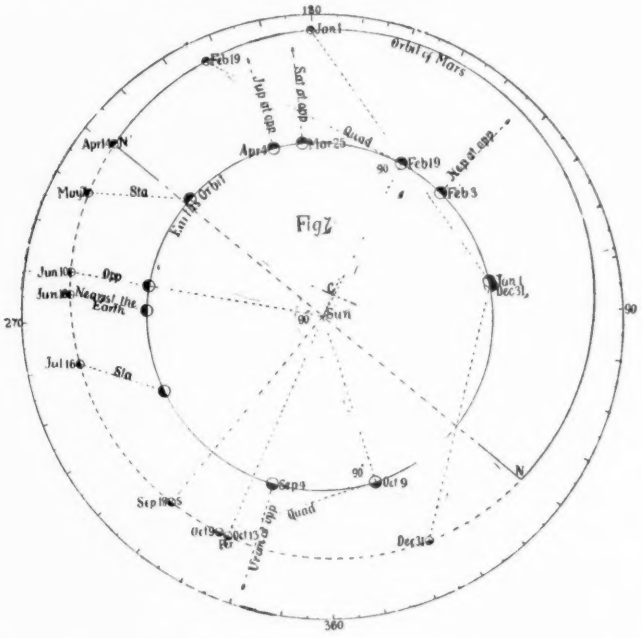
Fig. 6. In order to avoid confusion in the drawing, one quarter of the orbit, plotted by four arcs of circles, is shown separately. The radius of the arc *ac*, which passes through the vertex of the major axis, is 0.99; i. e. the centre *c*, from which the arc is described, is at a distance from the centre of the ellipse equal to 0.01. The eccentricity (0.093) is laid off to *S* the position of the sun. From this point as a centre, with a radius equal to the semi-major axis, describe an arc, intersecting the minor axis at its vertex *b*. The 45 degree line produced through *c*, intersects the minor axis at *f*, the centre from which the arc *bc* is described; and the drawing is completed as in Fig. 2 (p. 221).



Since the orbit is inclined to the ecliptic at an angle of only 1°.85 (cosine = 0.9995), its projection in a drawing of the dimensions here given does not differ appreciably from its true form.

Fig. 7. The major axis is drawn through the sun to the longitude of perihelion (334°.6). Assuming one third of an inch as representing

ten million miles, the length of the semi-major axis, or the mean distance, is $14.15/3 = 4.716$ inches. Multiplying the mean distance by the eccentricity, $4.716 \times 0.093 = 0.44$, the distance from the sun to C, the centre of the ellipse.



The earth's orbit, drawn to the same scale, is an eccentric circle whose radius is $9.29/3 = 3.096$ inches; and the centre is one-sixtieth of this dimension, or one-twentieth of an inch from the sun, laid off on the major axis, which is directed to the longitude of perihelion.

The period of Mars is 1.88 years. The drawing shows the distance the planet moves in its orbit during the year, and the relative positions of the earth and Mars on Jan. 1 and Dec. 31. Mars is in quadrature on Feb. 19; the planet reaches the descending node N′ Apr. 14; and it is apparently stationary May 7. Mars comes to opposition on June 10; but on this day is not as near the earth as on the 18th. The difference—due to the eccentricity of the orbit—is apparent even in a drawing of these dimensions. The planet is again stationary on July 16. If a plane be passed through the sun perpendicular to the ecliptic and to NN′, the trace of the plane of the orbit, it will be intersected by the orbit at S, the greatest heliocentric latitude south, a position which Mars reaches on Sept. 18. The planet is in quadrature on Oct. 9; and at perihelion Oct. 13.

Fig. 8. The apparent diameter of Mars changes rapidly as the planet approaches, or recedes from the earth. If it were at its maximum possible distance, and if the sun were out of the way, its diameter would be represented by the circle *a*. If an opposition should occur when Mars were at or near aphelion its diameter would be represented at *b*; *c* shows the diameter at the opposition of June 10; and *d* its maximum possible diameter when the planet is at opposition, and at the same time at or near perihelion.

In order to familiarize himself with the positions of the planets in conjunction, and of conjunction with the sun, the student should plot the orbits of Venus and Mercury by the reduced scale, and show the positions of the earth and the planets at one or more of the following dates: Feb. 24, Venus and Uranus; Feb. 28, Uranus with the sun; Mar. 25, Mercury and Uranus; June 30, Venus and Neptune; Aug 7, Mercury and Neptune; Aug. 8, Neptune with the sun; Aug. 15, Venus and Saturn; Aug. 26, Venus and Jupiter; Sept. 8, Mercury and Saturn; Sept. 21, Mercury and Jupiter; Oct. 4, Saturn with the sun; Oct. 8, Mercury and Jupiter; Oct. 23, Jupiter with the sun; Nov. 10, Mercury and Jupiter; and Dec. 24, Mars and Uranus.

In each case the direction in which the more distant planet is seen from the earth at the given date will be shown by the line connecting the earth with the nearer planet.

THE NEW INTERNATIONAL SYMBOLS FOR THE CONSTELLATIONS.

By HENRY NORRIS RUSSELL.

For almost a century chemists have had a distinct advantage over astronomers with respect to convenience of expression. The long Latin names of the elements in chemical literature are usually replaced by brief symbols familiar to everyone; but the long Latin names of the constellations have been printed in full (or somewhat curtailed) thousands upon thousands of times, in astronomical publications, when similar abbreviations would have answered every purpose. The aggregate cost of the extra printing involved must have been very considerable, and there is no reason for the continuance of this needless expense, especially in the present day of high prices.

The first astronomer to appreciate the importance of such abbreviations was Hertzsprung, who, in a recent publication,* has suggested a very compact system of symbols, composed of two letters each. From the standpoint of brevity and economy his symbols leave nothing to be desired. But they are open to certain objections.

In the first place, many of them are identical with the established symbols of the chemical elements. There is little danger that astronomers would be confused by this; but the ambiguity is undesirable.† and should be avoided in designing a new system. Moreover, symbols of two letters must necessarily be somewhat arbitrary (especially as the names of twenty-two constellations begin with C), but it is desirable that the symbols should suggest the constellations at a glance.

Symbols composed of three letters remove the first objection, and greatly reduce the second. An experimental list prepared by the writer was discussed with other astronomers on the voyage to Europe and at informal after-dinner meetings in Rome. The list, improved by various people, was then tried out on sundry others of different nationality, and appeared to be interpretable almost at first reading. It was then presented, along with Professor Hertzsprung's, at a meeting of the Committee on Units and Notation. A large majority favored the use of three letters, and a set of such symbols was recommended by the Committee and adopted at a plenary session of the International Astronomical Union.

No one is thereby placed under any obligation to use the new symbols, but it is hoped that their voluntary adoption may save a good deal of time and money, especially in tabulation.

It should be emphasized that they are symbols rather than abbreviations and not intended to be pronounced as separate words, but to be read as the Latin names (in the nominative or genitive as the syntax demands).

Before giving the list, a few words may be said regarding the principles on which they are formed. In most cases, the first three letters of the name suffice and are free from ambiguity. When these are the same for two or more constellations (as in Aquila and Aquarius) the initial letter and two other distinctive ones are employed. If the name consists of two words (e. g. Ursa Major) the two initials are capitalized and one other letter added.

These simple rules suffice for all cases. The most troublesome pair were Sagitta and Sagittarius, where distinctive letters could be found only by taking the genitive forms. The genitives are again suggested

*Annals of the Observatory of Leiden.

†A similar difficulty, involving notations already established, has been alleviated by the recommendation (adopted at the Rome meeting) that the letters denoting the Fraunhofer lines be printed in parentheses, those denoting spectral classes as Roman capitals, and the chemical symbols in Italics in astronomical literature, e. g. "The (B) group is not due to *B* nor characteristic of Class B."

in Hydra and Hydrus. The lady's name has been omitted from Coma Berenices (as is now customary). The other cases need no comment. The reader may amuse himself by covering up the Latin names in the table given below and trying how many of the symbols he can interpret at first glance.

INTERNATIONAL SYMBOLS FOR THE CONSTELLATIONS.

And	Andromeda	Lac	Lacerta
Ant	Antlia	Leo	Leo
Aps	Apus	Lep	Lepus
Aql	Aquila	Lib	Libra
Aqr	Aquarius	LMi	Leo Minor
Ara	Ara	Lup	Lupus
Arg	Argo	Lyn	Lynx
Ari	Aries	Lyr	Lyra
Aur	Auriga	Men	Mensa
Boo	Bootes	Mic	Microscopium
Cae	Caelum	Mon	Monoceros
Cam	Camelopardalis	Mus	Musca
Cap	Capricornus	Nor	Norma
Car	Carina	Oct	Octans
Cas	Cassiopeia	Oph	Ophiuchus
Cen	Centaurus	Ori	Orion
Cep	Cepheus	Pav	Pavo
Cet	Cetus	Peg	Pegasus
Cha	Chamaeleon	Per	Perseus
Cir	Circinus	Phe	Phoenix
CMa	Canis Major	Pic	Pictor
CMi	Canis Minor	PsA	Piscis Austrinus
Cnc	Cancer	Psc	Pisces
Col	Columba	Pup	Puppis
Com	Coma Berenices	Pyx	Pyxis
CrA	Corona Australis	Ret	Reticulum
CrB	Corona Borealis	Sae	Sagitta
Crt	Crater	Scl	Sculptor
Cru	Crux	Sco	Scorpius
Crv	Corvus	Sct	Scutum
CVe	Canes Venatici	Ser	Serpens
Cyg	Cygnus	Sex	Sextans
Del	Delphinus	Sgr	Sagittarius
Dor	Dorado	Tau	Taurus
Dra	Draco	Tel	Telescopium
Equ	Equuleus	TrA	Triangulum Australe
Eri	Eridanus	Tri	Triangulum
For	Fornax	Tuc	Tucana
Gem	Gemini	UMa	Ursa Major
Gru	Grus	UMi	Ursa Minor
Her	Hercules	Vel	Vela
Hor	Horologium	Vir	Virgo
Hya	Hydra	Vol	Volans
Hyi	Hydrus	Vul	Vulpecula
Ind	Indus		

In conclusion it should be emphasized that the credit for the suggestion of such symbols belongs entirely to Professor Hertzsprung—to whom astronomers will be increasingly indebted as they contemplate their reduced bills for printing.

Clark's Island, Plymouth, Mass., August 28, 1922.

FORMULAE FOR CALCULATING EPHEMERIDES OF THE MINIMA OF ALGOL.

By WILLIAM A. MASON.

Algol (*Beta Persei*) is a well known short-period binary near Cassiopeia, visible in the northern heavens from early September until April, when it is lost in the western evening glow. About every three days the primary is partially eclipsed for nearly ten hours, dropping from a star of magnitude 2.1 to one of magnitude 3.2. The eclipsing star is very dull, possessing only one-twentieth of the luminosity of the brighter star. Astronomers differ somewhat as to the exact size of the two stars, owing to periodic fluctuations in the light curve. They appear to be about the size of our own sun; one of them, probably the dark one, being possibly one-quarter larger in diameter. The most remarkable fact about these suns is that, being about a million miles in diameter, they are only three million miles apart from center to center. Further observations may alter these figures somewhat, but probably will not change the fact of these two suns revolving about each other at a tremendous rate of speed with their outer envelopes only about two million miles apart. The system appears to be a massive sun that has divided by fission, with the two companion bodies in the process of recession from each other, due to the reaction of tides mutually created.

The period of revolution of these stars about each other, or more correctly speaking about the center of gravity of the system, which now appears to include a third small member or satellite at a considerable distance in space, is very close to 2 da. 20 h. 48 m. 55 s.; or 3 h. 11 m. 5 s. less than three days. The revolution, however, is very slowly increasing and the period appreciably shortening, so that the minima at the present time occur several hours earlier in the day than the standard tables based on the older formulae would indicate. Professor Joel Stebbins in an article in the March number of the *Astrophysical Journal* for 1921 gives in considerable detail a description of the system of Algol and comments on the acceleration of the period of rotation, which he now estimates at 2 da. 20 h. 48 m. 54.9 s.

In preparing an ephemeris of the visible minima of Algol for the purposes of evening observations, one may start with a minimum occurring around midnight and add 2 da. 20 h. 48 m. 55s. to that time to obtain the next minimum and so on. But a more practical method is to add three days to the date and subtract 3 h. 11 m. 5 s. from the time. This process continued will give the three consecutive minima, about three days apart, visible three hours earlier each evening at some stage of an occultation. The occultation lasts 9.7 hours; about five hours waning to the minimum and about five hours waxing to full

illumination. When this is attained and the dark companion proceeds on its journey around and behind the bright star, Algol shines with full brilliancy for the intervening two evenings, except for a very slight secondary minimum of 0.04 loss of magnitude—an amount wholly invisible to the unaided eye—when the dull secondary disappears behind the brighter star. The third consecutive minimum in a series occurs in the late afternoon and only the last phase of the occultation is seen early in the evening. For two weeks (14 d. 8 h. 4 m. 35 s.) all the minima of Algol occur in the day time, the star continuing to shine brightly every night, except for some minor fluctuations detected only by the camera or the spectroscope. The next visible midnight minimum may be obtained by continuing to add three days and subtracting 3 h. 11 m. 5 s., through the period of the daytime minima for the intervening two weeks following the late afternoon minimum. This may be indefinitely continued through the winter to cover the entire ephemeris of the season's minima.

It will quickly be noted that this process is a most tedious one, consuming valuable time. A multiple period is needed that will include a series of minima, permitting the exclusion of all the day-light minima, and bridging over all the summer minima when Algol is below our northern horizon. In seeking such a multiple it was immediately discovered that sixty revolutions of Algol are covered in one-hundred and seventy-two days and fifty-five minutes. In other words, the sixtieth revolution repeats the series, but fifty-five minutes later. Consequently the following formulae offer a most satisfactory means of obtaining any series of minima:

1—120	revolutions	are	completed	in	344	da.	1	h.	50	m.
2— 60	"	"	"	"	172	"			55	"
3— 30	"	"	"	"	86	"			27	" 30 s.
4— 15	"	"	"	"	43	"			13	" 45 "

The initial minimum for a season's ephemeris occurring near the first of September in any year may be obtained by adding three hundred and forty-four days to the date of a minimum occurring near the twenty-first of September in the previous year and one hour and fifty minutes to the time. Or an early minimum in September may be obtained by adding one hundred and seventy-two days and fifty-five minutes to a minimum occurring late in March of the same year. One computation will check up the other.

In preparing the following table of the visible minima of Algol for the present season, use was made of the minimum of October 21, 1920, 18 h. 53 m. G. M. T. or October 22, 1 h. 53 m. E. S. T., as given by Professor Stebbins in the article quoted above. From this we obtain by adding 344 da. 1 h. 50 m., taken twice through 1920-1921 and 1921-1922, the minimum for September 10, 1922, 5 h. 33 m. A. M. By adding three days and subtracting 3 h. 11 m. 5 s. we find the minimum for September 13, 2 h. 21 m. 55 s. A. M., the initial date in our series. This

minimum has been proved by adding 172 d. 55 m. to our own corrected minimum of March 25, 1922, 1 h. 26 m. 55 s. A. M.

The succeeding minima for September are obtained by adding three days and subtracting 3 h. 11 m. 5 s., as already explained. It will be necessary to continue this latter operation throughout this first month, covering all the daylight minima when Algol shines brightly every night until we reach the next midnight minimum on October 6, 0 h. 53 m. 15 s. A. M. After this we can apply the last formula in our above list, thereby obviating this tedious calculation. It is necessary the first month, in order to obtain the date and hour of the next recurring series of minima on October 6, since forty-three, being a prime number, affords no smaller multiple.

MINIMA OF ALGOL FOR 1922-1923.
(Formula, add 43 d. 13 m. 45 s.)

1st Series						2nd Series					
		h	m	s				h	m	s	
Sept.	13,	2	21	55	A. M.	Oct.	6,	0	53	15	A. M.
	15,	11	10	50	P. M.		8,	9	42	10	P. M.
	18,	7	59	45	P. M.		11,	6	31	05	P. M.
	21,	4	48	40	P. M.		14,	3	20	00	P. M.
Oct.	26,	2	35	40	A. M.	Nov.	18,	1	07	00	A. M.
	28,	11	24	35	P. M.		20,	9	55	55	P. M.
	31,	8	13	30	P. M.		23,	6	44	50	P. M.
Nov.	3,	5	02	25	P. M.		26,	3	33	45	P. M.
Dec.	8,	2	49	25	A. M.	Dec.	31,	1	20	45	A. M.
	10,	11	38	20	P. M.	Jan.	2,	10	09	40	P. M.
	13,	8	27	15	P. M.	(1923)	5,	6	58	35	P. M.
	16,	5	16	10	P. M.		8,	3	47	30	P. M.
Jan.	20,	3	03	10	A. M.	Feb.	12,	1	34	30	A. M.
(1923)	22,	11	52	05	P. M.		14,	10	23	25	P. M.
	25,	8	41	00	P. M.		17,	7	12	20	P. M.
	28,	5	29	55	P. M.		20,	4	01	15	P. M.
Mar.	4,	3	16	55	A. M.	Mar.	27,	1	48	15	A. M.
	7,	0	05	50	P. M.		29,	10	37	10	P. M.
	9,	8	54	45	P. M.	Apr.	1,	7	26	05	P. M.
	12,	5	43	40	P. M.		4,	4	15	00	P. M.

The table is aranged in two columns to clearly indicate in this article that the midnight minimum of each series in the column is obtained by adding 43 da. 13 m. 45 s. to the preceding one. This skips over another series of minima which appears in the other column, the midnight minima of which are obtained in the same way, by adding 43 da. 13 m. 45 s. After the calculations are completed, the two columns may be combined and one list in chronological order may be made. The minimum of March 4, 3 h. 16 m. 55 s. A. M. has been proved by adding 344 da. 1 h. 50 m. to the minimum of March 25, 1922, 1 h. 26 m. 55 s. A. M. The entire set of calculations may be checked up by adding 14 da. 8 h. 4 m. 35 s. to the mid-afternoon minimum of the preceding series to obtain the midnight minimum of the next recurring series. One is cautioned, in applying these formulae in

preference to making the calculations from day to day throughout the calendar month and year, to add the extra day if the interval involved in any one of the four periods given includes February in a leap year.

The latest estimate of the parallax of Algol is $\pi = 0''.020$, the equivalent of 163 light years. It is interesting, therefore, in observing a minimum of Algol to recall that the events witnessed by the eye actually took place one hundred and sixty-three years ago.

The writer desires to acknowledge his indebtedness to Mr. Leon Campbell of the Harvard College Observatory for his helpful observations which have materially assisted us in verifying the minima of this most interesting star.

WHY I WOULD TAKE UP ASTRONOMY AS A PROFESSION

By RUFUS O. SUTER, JR.

An old Jewish adage says, "Serve God and man; but if thou canst not serve both, serve man." This interpretation of service has so influenced us that we measure the value of a profession by its usefulness to humanity. Many of the ancients studied astronomy to please the gods who created the stars. This view of the matter is no longer in keeping with our ideals. The man who does not benefit humanity by his life's work is either consigned to the failures or to the impractical theorists.

A great many laymen, some well educated, some tolerably broad-minded, include the astronomers among this latter group. From text books on the subject they know that astronomy is indispensable in chronology, surveying, navigation, and the determination of time, but they consider these poor apologies for one's spending his life measuring, weighing, and charting other worlds. What, then, is the real value of astronomy?

Let us glance at the social conditions of the world during that long period in which the Egyptian, the Persian, the Greek, and the Roman civilizations flourished. The period stretched over thousands of years; but little progress was made. The minds of men in general remained in a dormant state. All that great class of society which constitute the pith of humanity were happy to fall on their knees before their rulers, and worship them as if they were gods. If the chance was given them to die for some petty wish of a pharaoh or a king or an emperor they considered themselves fortunate. The idea never occurred to them that they were anything but tools in the grasp of a being divinely chosen to handle them. The rulers were as sincere in the belief of their own omnipotence as humanity was in the belief of its own unquestioning servility. The faith and allegiance of the common man was ideal; but it was blind as the faith and allegiance of a dog. Besides worshipping the ruler, the people worshipped the god that

made the ruler. Who was the god, whom they would have willingly died for in sacrifice?—a wolf, a cow, a stone image, or a Zeus. The mind of man was little broader than the mind of a dumb animal.

Now, let us look at the views of astronomy which these early people had—what was their concept of the Universe? They had no idea of infinity or eternity. Creation consisted of the earth, the visible stars, the sun and the moon. They believed the earth was flat, supported by pillars or tortoises or Atlas. They hadn't any definite idea even as to what they thought the stars and sun and moon were. Their theories were either half-hearted, or invented by poets seeking poetic ways to describe the exploits of heroes. The distinction between fact and fancy was vague. The stars were everything from sparks of fire placed in the sky by gods to guide heroes, to men and women who were being punished or rewarded.

Man could not broaden his mind; could not develop a lofty intellectual, social, or moral life because his philosophy concerned a Universe that possessed no broadening or elevating characteristics. He was hemmed in by a narrow philosophy, the result of a narrow, insufficient knowledge of the Universe.

From those ancient times to about the fifteenth century humanity on the whole showed little elevation. Suddenly Copernicus looms into prominence; after him, Bruno, Galileo, Kepler, and Newton. The shackles that have bound humanity are broken; man comes out from the narrow dark dungeon in which he has been imprisoned; and finds himself in a brilliant, healthy, liberty. He gazes into infinite, eternal space; sees innumerable, gigantic, burning, rolling suns; and numberless worlds. Into his philosophy burst ideas of universal life. He begins to comprehend distances, sizes, velocities and forces that overwhelm him. His concept of God is utterly changed.

There is no need to describe the influence of this Renaissance on society. From every standpoint man was broadened and elevated. From the year 1400 to 1922 more progress was made in the world than in all the preceding ages. Astronomers are still gazing into the depths of space, and discovering facts about the Universe around us. Our knowledge of space is increasing, and we are advancing with the growth of this knowledge. Perhaps the noblest aspiration of the intellect is to contemplate Creation; and if the time ever comes when every human being will possess the power to do so, and will freely exercise the power, we will have reached Utopia. Sir Edwin Arnold said: "Astronomy will eventually be the chief educator and emancipator of the human race."

Who now can relegate the astronomer to the crowd of impractical theorists? If a man has the inclination to devote his life to following Urania, he has chosen one of the noblest and most worthy of professions.

Warren, Pa.

A CENTURY SINCE THE GREAT HERSCHEL.

By MAYNARD SHIPLEY.

On August 25 of this year, a century was completed since Sir William Herschel—famous father of a famous son, celebrated brother of a celebrated sister, and himself one of the brightest stars of astronomical history—ended his long life two years after the inglorious demise of the mad king who had been his patron.

If anyone had asked Herschel's father, when the little boy saw the light of day in Hanover on November 15, 1738, what his son's future was to be, Herschel, Senior, would undoubtedly have answered, "He is to be a professional musician, as I am." And so William was—for he earned his living as an organist for many years; in fact he was fifty years of age before he was able to give all his time to astronomy. His devoted sister Caroline, who was for many years his indefatigable aid, has told how every night her brother would go to bed with two books—one on music, one on astronomy—which he would study until sleep overcame him.

Herschel's first telescope was made in 1774; not a very large one, perhaps, but consider that the speculum was ground by hand, by walking around and around it countless times, while the faithful Caroline fed him stimulants to keep him from exhaustion. Years later he made the greatest telescope of his time—a type of reflector still standard as "Herschelian", two feet larger than the reflector at Yerkes Observatory, one foot larger than that made famous by the epochal discoveries of Keeler at Lick Observatory (not to be confused, however, with the great *refracting* telescopes of these two observatories).

More important than any making of telescopes, however, are the intellectual achievements of Sir William Herschel. He was the discoverer of Uranus. He was first to see two of the moons of Saturn. He discovered the polar caps of Mars. He found that binary stars are subject to the law of gravitation. He estimated the position of the sun in the Milky Way—and modern astronomy has placed its solution of the direction toward which the solar system is moving only very slightly to the southeast of Herschel's calculation—between Hercules and Lyra, instead of in Hercules. This achievement of Herschel's the great Simon Newcomb said he regarded as the greatest accomplishment of the human mind.

Herschel drew up a catalogue of five thousand stars and star-clusters. He even had an adumbration of the modern "island universe" theory, which regards the spiral nebulae as other universes outside our own. Says Heber D. Curtis, director of Allegheny Observatory, with special reference to this feat of his gigantic mind, "The history of scientific discovery affords many instances where men with some strange gift of intuition have looked ahead from meager data, and

have glimpsed or guessed truths which have been fully verified only after the lapse of decades or centuries. Herschel was such a fortunate genius."

The great astronomer came to England as a young man, at the close of the long Seven Years' War between Frederick the Great and Maria Theresa; he became a naturalized British subject and eventually a baronet. In 1789 he was appointed Royal Astronomer to George III, after whom he had originally named the planet now called Uranus. For thirty-three years, ably assisted by his talented sister, he devoted his entire life to the solution of astronomical problems and the observation of the heavens. And when he died, just a century ago this summer, his only son, Sir John Herschel, continued his father's work for nearly half a century more.

When Euterpe, muse of music, lent to her sister Urania, muse of astronomy, the genius of William Herschel, the whole world of lovers of science had reason to be profoundly grateful. The son of the court musician of Hanover died one of the greatest astronomers of any land or time, and for a hundred years we have been building up a mighty structure of knowledge on the foundations Herschel laid.

GRAVITATION, III.

By WILLIAM H. PICKERING.

If we accept the view that the attractive force between two restrained bodies is due, not to their mutual attractions acting at a distance, but to the interaction of the lines of force generated by them, which intersect in the surrounding ether, we shall then arrive at several rather unexpected results. It would appear (*a*) that there is a unit attractive force, a minute fraction of a dyne, which cannot be subdivided. (*b*) This force is set free only when a line of force from each of the two bodies intersect. If no intersection occurs, then there is no attraction between them. (*c*) This unit attractive force is independent of the distance of the two bodies. (*d*) The attraction between two bodies then varies as the product of the number of lines of force from each which intersect. At $1/n$ the distance, there will be n^2 times the number of intersecting lines, which gives us the ordinary law of gravitation.

In order to determine the value of the attractive force in dynes, let us imagine two copper balls, each one centimeter in diameter, and in contact with one another. The specific gravity of copper is 8.7 and its atomic weight 63. The value of one dyne may be defined as the attraction between two spheres whose centers are one centimeter apart, and each of which contains very nearly 4000 grams of matter. Then each ball will contain 0.5236 cu. cm., and will have a mass of 4.55 gm. The attraction between them will be 1.3×10^{-6} dynes. The diameter

of an atom is approximately 1/100,000,000 cm. Therefore each sphere contains 10^{24} atoms, and 6.3×10^{25} protons, or condensed hydrogen nuclei. Dividing the attraction of the spheres by the square of this latter number gives us 3×10^{-58} dynes. This then is the unit gravitational attractive force between two restrained protons whose lines of force intersect, and is independent of the distance between them.

In the case of a planet revolving about the sun, the question has sometimes been asked is the force of gravitation instantaneous, or does it, like light, have a definite although high velocity? Since the planet merely moves in its orbit from certain lines of force to others that were previously there, it is clear that the action is strictly instantaneous. Whether we can under such circumstances say that the ether forces the planet towards the sun is largely a matter of definition of terms. There is clearly no attractive force between the planet and the sun, but is there a force between the planet and the ether? The planet takes the course of least resistance, which turns out to be an elliptical orbit with the sun in one of its foci. Should it leave this orbit it would experience a force moving it either towards or away from the sun, as the case might be. It would seem that a planet moving in a circular orbit would experience no force from the ether. If it did, work would be done. As to what the precise mechanism of gravitation may be we can at present only speculate, but we may perhaps compare its effect to that of a solenoid carrying a current, and having the proton at its middle point. In such a case each proton would carry two real tubes of force, tending to draw other protons through them.

Mandeville, Jamaica, B. W. I., June 9, 1922.

TWENTY-EIGHTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

The twenty-eighth meeting of the Society was held at the Yerkes Observatory, Williams Bay, Wisconsin, on September 5 to 8, 1922. This was the twenty-fifth anniversary of the opening of the Observatory and also of the founding of the Society, which grew out of the conference of astronomers held in connection with the dedication of the Observatory in 1897. The preliminary circular had indicated a great variety of ways of reaching the meeting, and the visitors utilized every opportunity except that by air. The members were quartered among beautiful surroundings at the Y. M. C. A. Camp on the shore of Lake Geneva.

The meeting opened on Tuesday evening with a reception at the home of Director and Mrs. Frost, which was held on the lawn by the light of the full moon. On this and the following evenings there was opportunity for the visitors to observe with the forty-inch refractor and other instruments of the Observatory.

The three days, Wednesday, Thursday, and Friday, were largely occupied with the program of papers, and so great is the present activity in American Astronomy that the number of communications make a crowded program. The labor of getting through the papers was increased by the extreme temperature, the thermometer rising as high as 100 degrees Fahrenheit, but this condition was ameliorated somewhat by frequent meetings in the lake. In the absence of the president and both vice-presidents, none of whom had apparently recovered from their trip to Rome for the international meeting, the successive sessions were presided over by Messrs. Fox, Russell, Slocum, Plaskett, Mitchell, and Boss.

On Wednesday evening Professor Barnard gave an illustrated lecture on "Some Peculiarities of the Comets," in which he not only gave an instructive address on these heavenly bodies but also traced the development of the art of comet photography, including some of his own epoch-making photographs taken at the Lick and Yerkes Observatories.

On Thursday afternoon the visitors enjoyed a ride around Lake Geneva on the steamers kindly furnished by friends of the Observatory. On the same evening was held the anniversary celebration, when Director Frost told of the history of the Yerkes Observatory, his story being supplemented by a letter from Dr. Hale, the first director, who gave an interesting account of the beginnings of the institution. Other messages were read, including one from Miss Furness, who was one of the three ladies present at the dedication, a number quite in contrast with the number present at the anniversary. Professor Frost also showed slides of the group photographs of the meetings of 1897 and 1909, in which were many familiar faces.

At the close of these reminiscences the opportunity was taken by Professor Fox to exhibit a slide of a portrait of Director Frost, to be presented to the Observatory, when finished, by numerous former and present members of the staff. Speaking on behalf of the donors, Professor Fox touched upon the affection and esteem with which the director is held by all who have been associated with him.

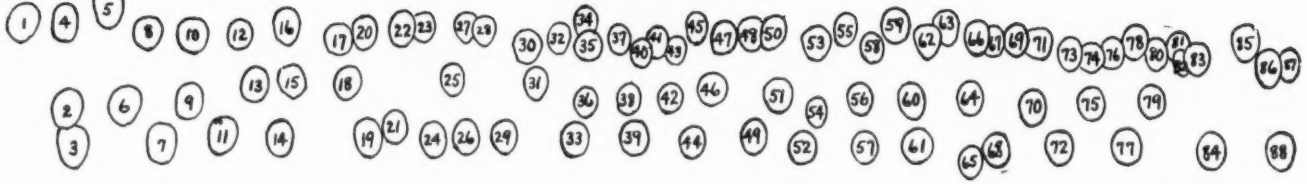
Other features of the program were a summary of the first twenty-five years of the history of the Society, given by the secretary, and a series of astronomical and Lake Geneva "movies," with reels from the Dearborn and Yerkes observatories, and summer and winter sports on Lake Geneva, all projected through the kindness of Mr. M. A. Healy.

On the final evening the festivities closed with a banquet, with appropriate astronomical talks under the leadership of Professor Fox as toastmaster.

This meeting marked the end of the three-year term of President Schlesinger, whose retiring address is given in the present report. According to a provision of the constitution, any person who has held

TWENTY-EIGHTH MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY, YERKES OBSERVATORY, SEPTEMBER 7, 1922.

Key to Plate XXX



1. Jewell
2. Blakslee
3. Rossiter
4. Ray Jewell
5. Alter
6. Haynes
7. Urie
8. Barrett
9. Stearns
10. King
11. Huffer
12. Adams
13. Lunn
14. E. C. Slipher
15. Russell
16. F. C. Jordan
17. Millis
18. L. R. Wylie
19. Van Biesbroeck
20. Schmidt
21. Miss Bigelow
22. Kazarinoff
23. Akeley
24. Hussey
25. Henroteau
26. Parkhurst
27. Elvey
28. Crump
29. Brasch
30. Mrs. Mitchell
31. Mitchell
32. Curtiss
33. Phillips
34. Lee
35. Mrs. Curtiss
36. Miss Calvert
37. Mrs. Lee
38. Miss Farnsworth
39. Stebbins
40. Miss Losh
41. Miss Anne Young
42. Miss Parsons
43. Miss Barney
44. Swezey
45. Struve
46. Miss Cable
47. Barnard
48. Brock
49. Ross
50. Frost
51. Mrs. Haynes
52. Miss Wickham
53. Mrs. Frost
54. Vincent Healy
55. Fox
56. Miss Swartz
57. Miss Hill
58. Miss Glancy
59. Morehouse
60. Mrs. C. C. Wylie
61. Miss Furrey
62. Silberstein
63. C. C. Wylie
64. Leach
65. Robert Fox
66. Slocum
67. R. M. Stewart
68. Mrs. Fox
69. Carr
70. De Lury
71. Miss Frost
72. Pawling
73. Mrs. Plaskett
74. Mrs. Healy
75. Albrecht
76. Miss Jessica Young
77. Meggers
78. Plaskett
79. Gingrich
80. Yowell
81. Mees
82. Mrs. Yowell
83. H. C. Wilson
84. Menzel
85. Burns
86. Mrs. H. C. Wilson
87. M. A. Healy
88. H. A. Howe

the office of president of the Society becomes a member of the council for life. The official ballot for new officers had been prepared by a committee consisting of E. S. King, Harriet W. Bigelow, and William Tyler Olcott, and the nominees were elected without opposition.

President	1922-1925	W. W. Campbell
Vice-President	1922-1924	Henry Norris Russell
Secretary	1922-1923	Joel Stebbins
Treasurer	1922-1923	Benjamin Boss
Councilors	1922-1925	John M. Poor
		Charles E. St. John
Member National Research Council	1923-1926	Ernest W. Brown

Officers continuing to serve are

Vice-President	1921-1923	John A. Miller
Councilors	1920-1923	Caroline E. Furness
	1921-1923	Philip Fox
	1921-1924	A. O. Leuschner
		Frederick Slocum
Members National Research Council	1920-1923	W. W. Campbell
	1921-1924	Henry Norris Russell
	1922-1925	Edwin B. Frost

Nineteen new members were elected by the Council at the meeting and during the year, making a total membership of three hundred and ninety.

Mrs. Ethel Serviss Ackerman, Closter, N. J.
G. C. Blakslee, Yerkes Observatory, Williams Bay, Wis.
Lewis A. Brigham, Boylston & Exeter Sts., Boston, Mass.
L. C. Damsgard, Takoma Park Station, Washington, D. C.
C. T. Elvey, Department of Astronomy, University of Kansas, Lawrence, Kansas.
Priscilla Fairfield, Smith College, Northampton, Mass.
C. M. Huffer, Washburn Observatory, Madison, Wis.
Donat K. Kazarinoff, Department of Mathematics, University of Michigan, Ann Arbor, Mich.
Florence P. Lewis, Goucher College, Baltimore, Md.
Hazel M. Losh, Detroit Observatory, Ann Arbor, Mich.
W. J. Luyten, Lick Observatory, Mt. Hamilton, Calif.
W. D. Morgan, 740 Curfew Ave., St. Paul, Minn.
K. B. Patterson, 501 Oakwood Ave., Durham, N. C.
W. R. Paul, 327 West 69th St., Chicago, Ill.
J. A. Pearce, Lick Observatory, Mt. Hamilton, Calif.
R. A. Rossiter, Detroit Observatory, Ann Arbor, Mich.
D. E. Sharp, Spencer Lens Co., Hamburg, N. Y.
Otto Struve, Yerkes Observatory, Williams Bay, Wis.
E. W. Sundell, 225 N. Grove Ave., Oak Park, Ill.

The following members were present at the Yerkes meeting:

Sebastian Albrecht	Mary R. Calvert	A. Estelle Glancy
Dinsmore Alter	F. E. Carr	E. S. Haynes
E. E. Barnard	C. C. Crump	F. Henroteau
Ida Barney	R. H. Curtiss	Laura E. Hill
S. B. Barrett	R. E. De Lury	H. A. Howe
Harriet W. Bigelow	C. T. Elvey	C. M. Huffer
G. C. Blakslee	Alice H. Farnsworth	W. J. Hussey
Benjamin Boss	Philip Fox	W. R. Jewell
F. E. Brasch	E. B. Frost	F. C. Jordan
Keivin Burns	C. H. Gingrich	D. K. Kazarinoff

E. S. King	Jesse Pawling	Otto Struve
O. J. Lee	E. C. Phillips	Helen M. Swartz
Hazel M. Losh	J. S. Plaskett	G. D. Swezey
A. C. Lunn	F. E. Ross	Frank D. Urie
C. E. K. Mees	R. A. Rossiter	G. Van Biesbroeck
W. F. Meggers	H. N. Russell	Evelyn W. Wickham
D. H. Menzel	R. E. Schmidt	H. C. Wilson
John Millis	Ludwik Silberstein	C. C. Wylie
S. A. Mitchell	E. C. Slipher	L. R. Wylie
D. W. Morehouse	Frederick Slocum	Anne S. Young
J. A. Parkhurst	C. L. Stearns	Jessica M. Young
Harriet McW. Parsons	Joel Stebbins	Everett I. Yowell
W. R. Paul	R. M. Stewart	

At the final session, the Society passed resolutions of thanks to the director and staff of the Yerkes Observatory for the hospitality extended; a message of congratulation was sent to Professor Hiram Perkins, founder of the Perkins Observatory of Ohio-Wesleyan University, and a message of condolence to Mrs. Kapteyn in appreciation of the late Professor J. C. Kapteyn, an honorary member of the Society.

The Council had previously determined that the next meeting of the Society would be held in affiliation with the American Association for the Advancement of Science at Boston and Cambridge in December 1922, and the next summer meeting at the Mount Wilson Observatory in September 1923.

(To be continued.)

Hope.

Cheer up, ye men who are weary of life,
Look up to the skies above,
Through the wid'ning rifts in the clouds of strife
Still twinkle the stars of love:—

Stars that are aged with the age of Space,
With the age of Time grown old.
They hurtle along their orbital race
Till they too are dead and cold.

But the Master, Science, of earth has taught
That these dead embers of stars
Are hurl'd and are whirl'd and finally are wrought
Into other newborn stars.

A Chaos of matter and space and time
But ruled by Infinite Love—,
Cheer up, ye men who are weary of life,
Look up to the stars above.

No atom is dead, nor a mighty world,
Is lost in this sea of night—
A chaos that's hurl'd and mightily whirl'd
And wrought into worlds of light.

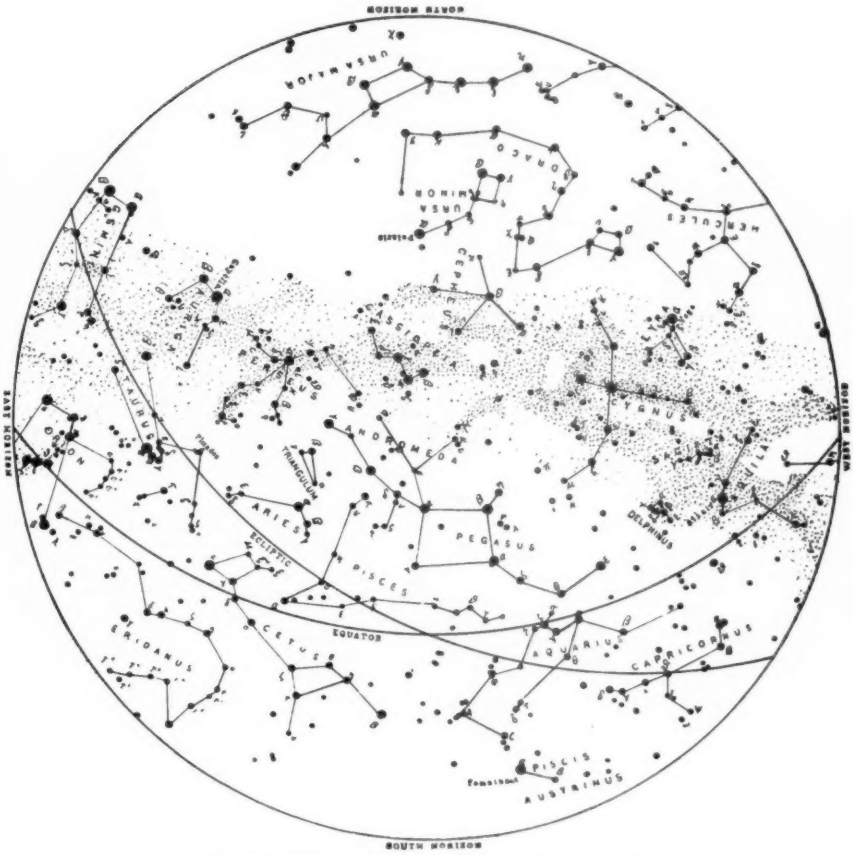
Cheer up, ye men who are weary of strife,
Ye who are afraid to die,
Through the wid'ning rifts the lesson of life
Is borne from the starlit sky.

Springtown, Texas. STERLING BUNCH.

PLANET NOTES FOR NOVEMBER.

The *Sun* will move eastward from R. A. $14^h\ 24^m$ to R. A. $16^h\ 23^m$ and in declination from $-14°\ 16'$ to $-21°\ 44'$ during the month. It will move from the constellation Libra into the constellation Scorpio, and at the end of the month will be a short distance northeast of Antares.

The phases of the *moon* will occur as follows:



THE CONSTELLATIONS AT 9:00 P. M. NOVEMBER 1.

Full Moon	Nov. 4	at	12:36 P. M.	C. S. T.
Last Quarter	12	"	1:52 A. M.	"
New Moon	18	"	6:06 P. M.	"
First Quarter	26	"	2:15 A. M.	"

Mercury will be too near the sun to be seen at any time during November. At the beginning of the month it will be one hour west of the sun, but will

be moving eastward more rapidly than the sun so that at the end of the montl the two bodies will be nearly in conjunction.

Venus will be very low in the southwestern sky at sunset on November 1. On November 4 it will begin to move westward. It will approach the sur rapidly and be at inferior conjunction with the sun on November 24. It will consequently be practically invisible throughout the month.

Mars will continue to be visible just west of the meridian at sunset. Since it is about 19 degrees south of the equator it will not be well situated for observations by northern observers.

Jupiter will rise about two hours before the sun.

Saturn will rise a little while before Jupiter at a point on the horizon a few degrees north of the rising point of Jupiter.

Uranus will be well situated for observation in November. It will be near the meridian at sunset.

Neptune will be in quadrature, 90° west of the sun, on November 10. It will therefore be visible in the early morning and will be near the meridian at sunrise.

Occultations Visible at Washington.

[From the American Ephemeris.]

Date 1922	Star's Name	Magnitude	IMMERSION. Washington M.T.	IMMERSION. Angle from N	EMERSION. Washington M.T.	EMERSION. Angle from N	Duration
			h m	°	h m	°	h m
Nov. 3	ξ Arietis	5.5	16 16	103	17 14	233	0 58
4	147 B. Arietis	5.8	11 12	53	12 38	266	1 26
6	318 B. Tauri	5.7	16 44	126	17 44	233	1 0
7	130 Tauri	5.6	14 21	149	15 4	207	0 43
8	26 Geminorum	5.2	13 59	102	15 26	263	1 26
10	29 Cancri	5.9	11 49	142	12 33	231	0 44
24	53 B. Aquarii	6.5	5 47	105	6 54	210	1 8

COMET AND ASTEROID NOTES.

Wolf's Periodic Comet; Close Approach to Jupiter in 1922.—In the *Astronomical Journal* No. 807 Mr. M. Kamensky gives preliminary results of calculations of the path of Wolf's periodic comet, while near aphelion in the vicinity of the planet Jupiter during this year. The least distance between Jupiter and the comet occurred Sept. 26, 1922, Δ being then 0.1220 of the earth's mean distance from the sun, or about 11,000,000 miles. The comet entered into the sphere of activity of Jupiter, i. e. the sphere within which Jupiter's influence is greater than that of the sun, on July 8, 1922, and leaves it on Dec. 15, 1922. During that interval the changes of the orbit of the comet are large, the mean daily motion diminishing from 528″.4 to 428″.5 with a resulting increase of the comet's period from 6.7 years to 8.3 years. Perihelion distance of the new orbit will be about 2.40, instead of 1.59 as during recent years. It is interesting to note that the orbit goes back approximately to the size it had before the comet came within the sphere of activity of Jupiter in 1875.

VARIABLE STARS.

Minima of Variable Stars of Short Period.

[Calculated by members of the class in General Astronomy at Carleton College.]

Given to the nearest hour in Greenwich mean time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of minima in 1922 November							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8							22 19	
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	7 18	15 10	23 2	30 18				
UU Androm	38.5	+30 24	10.7—11.9	1 11.7	6 2	13 12	20 23	28 9				
U Cephei	0 53.4	+81 20	7.0— 9.0	2 11.8	2 3	9 15	17 2	24 14				
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	4 13	10 16	22 21	29 0				
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	2 12	9 16	16 19	23 22				
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	5 10	12 7	19 3	26 0				
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	1 9	8 13	22 21	30 1				
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	4 8	13 2	21 21	30 16				
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	6 22	14 20	22 19	30 18				
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6	1 5							
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	6 7	14 21	23 12					
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	1 0	7 19	21 9	28 4				
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	5 17	13 15	21 12	29 10				
RW Tauri	3 57.8	+27 51	7.1—<11	2 18.5	5 18	14 2	22 9	30 16				
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	6 23	14 21	22 18	30 16				
RW Persei	13.3	+42 04	8.8—11.0	13 04.8		11 15	24 20					
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	5 21	15 7	24 18					
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	3 22	16 8	28 18					
TT Aurigæ	5 02.8	+39 27	7.8— 8.7	0 16.0	4 23	11 15	18 7	24 23				
RY Aurigæ	11.5	+38 13	10.7—11.7	2 17.5	8 19	16 23	25 4					
RZ Aurigæ	42.9	+31 40	10.6—13.3	3 00.3	4 4	10 4	22 5	28 6				
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	4 20	13 12	22 4	30 20				
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	5 11	15 21	26 7					
SV Gemin.	54.6	+24 28	9.8—<11	4 00.2	7 16	15 17	23 17					
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	1 7	12 18	24 5	29 22				
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	3 5	8 19	20 0	25 15				
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	8 3	16 8	24 13					
RW Monoc	29.3	+ 8 54	9.0—10.8	1 21.7	1 18	9 9	17 0	24 15				
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0		7 2	19 7					
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	6 4	13 8	20 12	27 16				
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	5 6	12 1	18 21	25 17				
RY Gemin.	21.7	+15 52	8.9—<10	9 07.2	4 3	13 10	22 17					
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	1 9	8 0	21 5	27 20				
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	9 0	17 10	25 20					
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	2 18	9 4	22 1	28 11				
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	3 15	10 21	18 4	25 11				
X Carinae	8 29.1	—58 53	7.9— 8.7	0 13.0	1 3	9 6	17 9	25 12				
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	6 7	13 18	23 6					
RX Hydræ	9 00 8	— 7 52	9.1—10.5	2 06.8	6 6	13 2	19 23	26 19				
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	4 18	10 17	22 14	28 12				
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	3 6	10 0	23 12	30 6				
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	3 7	10 17	18 3	25 13				
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	5 1	11 15	24 20	30 10				
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	9 5	18 0	26 19					
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	3 8	10 16	17 23	25 8				
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	4 14	11 8	18 11	24 23				
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	1 11	8 23	16 11	23 23				
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1	8 15	18 5	28 19					
SS Centauri	07.2	—63 37	8 8—10.4	2 11.5	1 14	8 1	16 11	23 22				
133926 Hydræ	13 39.0	—26 23	8.6—12.7	2 21.5	2 23	8 19	20 9	26 4				

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of minima in 1922 November					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
δ Libræ	14 55.6	— 8 07	4.8— 6.2	2 07.9	5 19	12 16	19 13	26 11		
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	4 10	11 8	18 6	25 4		
TW Draconis	32.4	+64 14	7.3— 8.9	2 19.3	1 11	9 21	18 6	26 16		
SS Librae	15 43.4	—15 14	9.3—11.5	0 18.4	8 15	14 6	23 22			
SW Ophiuchi	16 11.1	— 6 44	9.2—10.0	2 10.7	7 1	14 10	21 18	28 2		
SX Ophiuchi	12.6	— 6 25	10.5—11.2	2 01.5	4 15	12 21	21 3	30 9		
R Aræ	31.1	—56 48	6.8— 7.9	4 10.2	3 4	12 1	20 21	29 17		
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1	3 16		24 10			
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	6 17	13 12	20 8	27 3		
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	0 20.1	3 8	11 18	20 3	28 12		
u Herculis	13.6	+33 12	4.6— 5.4	2 01.2	5 6	11 10	23 17	29 21		
TX Herculis	15.4	+42 00	8.3— 9.0	1 00.7	6 1	12 5	24 14	30 18		
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	4 5	11 14	18 23	26 8		
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	3 21	12 1	20 5	28 10		
TX Scorpii	48.6	—34 13	7.5— 8.2	0 22.6	5 21	13 10	20 23	28 12		
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	3 20	11 14	19 8	27 2		
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	8 17	16 17	24 17			
WX Sagittarii	53.6	—17 24	9.2—10.8	2 03.1	4 10	12 22	21 11	29 23		
WY Sagittarii	17 54.9	—23 01	9.5—10.6	4 16.0	6 13	15 21	23 5			
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	7 15	18 0	28 8			
RS Sagittarii	11.0	—34 08	5.9— 6.3	2 10.0	3 2	10 8	17 14	24 20		
V Serpentis	11.1	—15 34	9.5—11.1	3 10.9	1 18	8 15	22 11	29 9		
RZ Scuti	21.1	— 9 15	7.4— 8.3	15 03.2	2 21		18 0			
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	3 18	10 21	18 1	25 5		
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	7 23	15 1	22 4	29 7		
SX Sagittarii	39.7	—30 36	8.7— 9.8	2 01.8	6 0	14 8	22 15	30 22		
RR Draconis	40.8	+62 34	9.3—13	2 19.9	3 15	12 3	20 14	29 2		
RS Scuti	43.7	—10 21	9.3—10.3	0 15.9	4 10	11 1	17 17	24 8		
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	2 2	15 0	27 21			
U Scuti	18 48.9	—12 44	9.1— 9.6	0 22.9	3 2	10 18	18 9	26 1		
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4		8 11	16 1	23 15		
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	1 2	8 7	22 16	29 21		
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	5 5	14 4	23 3			
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	5 6	13 0	18 18	25 12		
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	3 7	10 16	18 1	25 10		
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	2 17	13 5	23 17	28 23		
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	3 7	9 19	22 21	29 9		
SY Cygni	19 42.7	+32 28	10 —12	6 00.2	1 1	7 1	19 2	25 2		
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	3 6	8 21	22 4	28 19		
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	3 7	12 11	21 14	30 17		
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	3 16	12 2	20 12	28 23		
RW Capric.	12.2	—17 59	8.8—10.6	3 09.4	2 8	9 3	22 16	29 11		
UW Cygni	19.6	+42 55	10.5—13	3 10.8	2 20	9 17	16 15	23 12		
V Vulpec.	32.3	+26 15	8.2— 9.8	37 19.0	5 18					
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	1 0	10 14	20 5	29 20		
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	7 19	17 0	26 5			
Y Cygni	48.1	+34 17	7.1— 7.9	1 12.0	7 0	14 12	22 0	29 11		
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	7 7	14 21	22 11	30 2		
RR Vulpec.	20 50.5	+27 32	9.6—11.0	5 01.2	9 2	19 5	29 7			
VVCygni	21 02.3	+45 23	12.1—13.8	1 11.4	4 10	11 19	19 16	26 14		
AE Cygni	09.0	+30 20	10.8—11.4	0 23.3	2 0	11 17	21 10			
RY Aquarii	14.8	—11 14	8.8—10.4	1 23.2	8 18	16 15	24 11			
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	1 19	11 23	21 2			
UZ Cygni	55.2	+43 52	8.9—11.6	31 07.3			22 22			
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	1 2	6 6	16 15	27 0		
VW Pegasi	51.7	+32 41	10.0—10.6	5 06.4	3 16	14 5	24 18	30 0		
TT Androm.	23 08.7	+45 36	11.3—12.6	2 18.4	3 8	11 15	19 22	28 5		
Y Piscium	29.3	+ 7 22	9.0—12.0	3 18.3	1 5	8 18	16 6	23 19		
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	7 7	15 13	23 19			

Maxima of Variable Stars of Short Period.

[Calculated by members of the class in General Astronomy at Carleton College.]

Given to the nearest hour in Greenwich mean time; to obtain Eastern Standard time subtract 5h; Central Standard time 6h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of maxima in 1922							
					November							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7	1 21							
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	6 5	14 8	22 11	30 15				
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	2 15	10 17	17 18	25 12				
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2		8 7	23 3					
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	3 12	11 11	19 9	27 8				
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	5 7	13 2	20 21	28 16				
TU Persei	3 01.8	+52 49	11.4—12.2	0 14.6	5 15	12 22	20 5	27 12				
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0	2		18					
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	3 12	12 2	20 16	29 6				
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	3 0	14 3	25 6					
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0	2 8	13 23	25 14					
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	8 7	15 23	23 14					
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3	9 5	19 8	29 11					
Y Aurigae	21.5	+42 21	8.6— 9.6	3 20.6	4 7	12 0	19 18	27 11				
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	2 16	13 18	24 19	30 8				
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	7 22	15 11	23 1	30 15				
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3			23 20					
RT Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	3 1	10 12	17 23	25 10				
RZ Camelop.	23.7	+67 06	11.0—13.0	0 11.5	7 0	14 5	21 10	28 15				
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	8 3	16 1	23 23					
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	4 8	14 12	24 15					
RU Camelop.	7 10.9	+69 51	8.5— 9.8	22 06.5	6 16		28 22					
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	3 15	11 14	19 13	27 11				
V Carinæ	8 26.7	—59 47	7.4— 8.1	6 16.7	3 4	9 21	23 6	29 23				
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	5 1	14 8	23 15					
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	2 8	11 1	19 19	28 13				
Z Leonis	9 46.4	+27 22	7.9— 9.6	59 00.0		12						
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	2 1	8 20	22 9	29 4				
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	3 11	10 1	23 6	29 21				
S Muscæ	12 07.4	—69 36	6.4— 7.3	9 15.8	4 4	13 20	23 12					
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	7 5	15 4	23 3					
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	3 19	10 12	24 0	30 17				
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	3 18	9 14	21 5	27 1				
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	6 13	15 22	25 7	29 0				
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5	5 12		22 19					
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	5 19	14 0	22 5	30 10				
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	6 19	13 20	20 20	27 21				
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	6 17	14 22	23 3					
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	6 8	11 20	22 19	28 7				
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	7 13	15 2	22 15	30 4				
RU Bootis	14 41.5	+23 44	12.8—14.3	0 11.9	7 11	14 21	22 7	29 16				
R Triang. Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	7 2	13 21	20 16	27 10				
S Triang. Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	4 14	10 22	23 13	29 21				
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	8 20	18 14	28 8					
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	1 9	10 5	19 2	27 23				
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	2 14	8 15	20 18	26 20				
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	5 0	12 1	19 1	26 1				
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9	4 11		21 14					
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	3 11	11 1	18 16	26 6				
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	2 13	8 8	19 21	25 15				
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	6 23	13 16	20 10	27 4				
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	4 14	14 22	25 6					
Y Lyræ	34.2	+43 52	11.3—12.3	0 12.1	1 23	8 0	20 2	26 2				
RZ Lyræ	18 39.9	+32 42	9.9—11.2	0 12.3	5 15	11 18	24 0	30 4				

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich mean times of maxima in 1922 November					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
RT Scuti	18 44.1	−10 30	9.1— 9.7	0 11.9	2 13	8 11	20 9	26 8		
κ Pavonis	18 46.6	−67 22	3.8— 5.2	9 02.2	7 7	16 9	25 12			
U Aquilæ	19 24.0	− 7 15	6.2— 6.9	7 00.6	2 5	9 6	23 7	30 8		
XZ Cygni	30.4	+56 10	8.6— 9.3	0 11.2	7 14	14 14	21 14	28 14		
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	2 8	10 7	18 7	26 6		
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	4 2	11 18	19 11	27 3		
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	8 3	15 7	22 12	29 16		
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	7 2	15 12	23 21			
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	7 0	13 8	19 16	25 23		
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3	5 13		21 23			
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	5 1	13 22	22 19	27 5		
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	3 7	10 1	23 12	30 5		
RV Capric.	55.9	−15 37	9.2—10.1	0 10.7	4 2	10 19	24 6	30 23		
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4	1 9	16 2	30 20			
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	6 16	14 13	22 9	30 6		
SW Aquarii	10.2	− 0 20	9.9—10.8	0 11.0	6 12	13 9	20 6	27 4		
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	1 14	11 8	21 1	30 19		
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	9 13	18 5	26 20			
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	4 1	9 10	14 18	20 3		
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1	1 13	12 11	23 8			
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	5 1	11 11	24 7	30 17		
V Lacertae	44.5	+55 48	8.5— 9.5	4 23.6	5 9	15 8	25 8	30 7		
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	1 5	12 2	23 0	28 11		
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	4 11	9 21	20 18	26 5		
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	6 0	12 7	18 14	24 21		
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4	6 11	18 14	30 17			
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	1 13	8 12	22 12	29 11		

New Variable Star of Long Period, *104453*.—Concerning a faint star in the position R. A. $10^h\ 44^m.8$, Dec. −53° 39′ (1900), Miss Cannon writes from Arequipa that the spectrum on April 12, 20, and 22, 1922, is of type M with bright hydrogen lines, Hδ being four times as bright as Hγ and the continuous spectrum faint.

Miss Woods has verified the suspected variability of the star from an examination of about twenty-five plates, made throughout the interval 1890 to 1922, and derives the elements:

$$\text{Max.} = \text{J. D. } 2416977 + 409^d\ E.$$

The photographic range is from 11.4 to 14.2.

Harvard College Observatory Bulletin 771,
Cambridge, Massachusetts, July 3, 1922.

Monthly Report of the American Association of Variable Star Observers, June 20 to August 20, 1922.

The large double report presented herewith owes a great deal to the unremitting efforts of a long list of able observers. Messrs. Christie, Elmer and Merola are new observers, and we are also very glad to receive observations made by Professor Parkhurst and the Misses Farnsworth and Bigelow of the Yerkes Observatory, as observations of faint minima are very desirable. It is a pleasure to report that Mr. McAteer, one of our most faithful members, who

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922.

June 0 = J. D. 2423206 July 0 = J. D. 2423236 August 0 = J. D. 2423267

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
001046 X ANDROMEDAE—												
	3223.9	<13.5	Wf,	3230.9	<14.0	Wf,	3236.8	<12.5	M,	3259.9	14.3	Wf,
	3262.8	<12.5	M,	3266.9	14.0	Wf.						
001620 T CETI—												
	3234.6	6.6	L,	3256.2	6.4	Kd,	3262.6	5.9	L,	3263.6	5.5	An,
	3265.6	5.5	An,	3267.5	5.4	An.						
001726 T ANDROMEDAE—												
	3199.4	<11.5	Ch,	3227.8	12.4	Pt,	3235.9	<11.5	Br,	3236.8	12.0	M,
	3239.4	12.0	Ch,	3264.8	11.0	Pt,	3286.8	8.6	M.			
001755 T CASSIOPEIAE—												
	3199.4	7.8	Ch,	3220.6	7.7	Gi,	3227.8	7.2	Pt,	3227.8	7.5	M,
	3230.4	7.3	L,	3234.5	7.7	Gi,	3240.4	7.3	Ch,	3243.6	7.5	O,
	3244.8	7.3	M,	3246.5	7.6	Gi,	3255.4	7.6	L,	3261.8	7.3	M,
	3262.5	7.7	Gi,	3264.8	7.2	Pt.						
001838 R ANDROMEDAE—												
	3199.4	<11.0	Ch,	3223.9	13.5	Wf,	3227.8	12.5	Pt,	3230.9	13.7	Wf,
	3235.9	<11.6	Br,	3237.4	<11.6	Ch,	3259.9	14.1	Wf,	3264.8	13.9	Pt,
	3266.9	<14.1	Wf,	3267.7	<12.0	Fn.						
001909 S CETI—												
	3234.6	<13.2	L,	3240.4	<11.5	Ch,	3262.6	14.0	L.			
003179 Y CEPHEI—												
	3227.8	12.5	M.									
004047 U CASSIOPEIAE—												
	3223.9	12.4	Wf,	3225.8	<11.1	Hj,	3227.8	12.3	Pt,	3230.9	12.0	Wf,
	3235.8	<11.1	Hj,	3236.8	12.0	M,	3240.7	11.4	Hj,	3253.7	10.1	Lc,
	3254.7	10.5	Hj,	3259.9	9.7	Wf,	3261.8	9.5	M,	3264.8	9.5	Pt,
	3265.7	9.2	Hj,	3266.9	9.0	Wf.						
004132a RW ANDROMEDAE—												
	3240.8	10.2	M,	3262.9	8.6	Wf,	3265.8	9.5	M,	3285.7	8.8	Pt.
004435 V ANDROMEDAE—												
	3237.8	11.2	M,	3265.8	12.6	M.						
004533 RR ANDROMEDAE—												
	3223.9	<14.0	Wf,	3230.9	<14.0	Wf,	3259.9	<14.0	Wf,	3266.9	<14.0	Wf,
	3286.8	13.2	M.									
004746a RV CASSIOPEIAE—												
	3227.8	14.6	Pt.	3237.6	<14.0	L,	3262.9	<14.0	Wf,	3264.8	14.8	Pt.
004958 W CASSIOPEIAE—												
	3221.9	10.4	Br,	3227.5	10.3	Gi,	3227.8	11.0	Pt,	3227.8	10.7	M.
	3235.8	10.7	Br,	3241.5	10.5	Gi,	3250.6	<11.0	Cg,	3252.7	11.3	Lc,
	3256.5	10.7	Gi,	3261.8	12.2	M,	3262.6	9.4	Cg,	3264.8	11.8	Pt.
	3280.7	<9.5	Cg,	3281.6	10.1	Cg.						
010940 U ANDROMEDAE—												
	3223.9	10.0	Wf,	3230.9	9.9	Wf,	3236.8	10.2	M,	3246.8	10.6	M,
	3259.9	10.6	Wf,	3262.8	11.0	M,	3266.9	10.8	Wf.			
011041 UZ ANDROMEDAE—												
	3223.9	13.2	Wf,	3230.9	13.3	Wf,	3235.9	<11.5	Br,	3246.8	11.0	M,
	3259.9	14.2	Wf,	3262.8	<11.0	M,	3266.9	14.2	Wf.			
011272 S CASSIOPEIAE—												
	3227.8	11.8	Pt,	3230.9	12.2	Wf,	3259.9	12.8	Wf,	3264.8	12.5	Pt,
	3267.7	13.3	Fn.									
011712 U PISCIUM—												
	3262.8	11.5	M,	3264.8	12.8	Pt,	3286.8	12.0	M.			
012350 RZ PERSEI—												
	3246.8	11.5	M.	3286.8	12.5	M.						
012502 R PISCIUM—												
	3241.8	8.3	Pt,	3262.8	9.0	M,	3264.8	9.6	Pt,	3286.8	10.5	M.
013238 RU ANDROMEDAE—												
	3223.9	11.7	Wf,	3227.8	12.8	Pt,	3230.9	12.8	Wf,	3239.4	<11.0	Ch,
	3246.8	11.7	M,	3259.9	13.5	Wf,	3264.8	13.5	Pt,	3265.8	<12.1	M.

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.
013338 Y ANDROMEDAE—								
	3227.8	9.1 Pt,	3239.4	10.0 Ch,	3246.8	10.2 M,	3264.8	11.2 Pt,
	3265.8	11.5 M.						
014958 X CASSIOPEIAE—								
	3227.8	9.8 Pt,	3227.8	11.3 M,	3264.8	9.8 Pt,	3286.8	11.8 M.
015354 U PERSEI—								
	3227.8	9.1 Pt,	3227.8	9.3 M,	3264.8	9.5 Pt,	3282.6	9.0 Cg.
015912 S ARIETIS—								
	3241.8	12.1 Pt,	3262.8	11.3 M,	3264.8	11.4 Pt,	3286.8	11.8 M.
021024 R ARIETIS								
	3228.8	10.4 Pt,	3240.4	10.6 Ch,	3241.5	10.5 Gi,	3246.8	11.3 M,
	3255.5	11.7 Gi,	3262.6	13.0 L,	3262.8	11.0 M,	3264.8	12.5 Pt.
021143a W ANDROMEDAE—								
	3223.9	12.6 Wf,	3230.9	12.4 Wf,	3240.4<12.1 Ch,		3241.5	11.4 Gi,
	3251.8<11.2 M,		3255.5	11.2 Gi,	3259.9	11.1 Wf,	3267.5	10.7 Gi,
	3286.8	10.2 M.						
021281 Z CEPHEI—								
	3220.8	12.7 Wf,	3221.8<12.0 Br,		3230.9	13.1 Wf,	3238.9	13.5 Wf,
	3246.8<12.5 M,		3260.8	13.5 Wf,	3262.9<14.2 Wf,		3263.7	14.4 Wf,
	3264.9	14.2 Wf,	3265.8	14.2 Wf.				
021403 o CETI—								
	3229.3	5.6 Kd,	3237.6	5.4 L,	3239.4	5.5 Ch,	3241.8	5.0 Pt,
	3257.2	6.5 Kd,	3262.6	6.2 L,	3264.8	6.3 Pt,	3265.8	6.6 M,
	3284.8	6.5 Pt.						
021558 S PERSEI—								
	3265.8	10.7 M.						
022150 RR PERSEI—								
	3220.8	12.5 Wf,	3221.9<11.3 Br,		3230.9	12.8 Wf,	3235.9<11.6 Br,	
	3262.9	13.8 Wf.						
022813 U CETI—								
	3264.8	12.8 Pt.						
022980 RR CEPHEI—								
	3220.8	10.5 Wf,	3221.8	10.6 Br,	3230.4	10.3 L,	3230.9	10.3 Wf,
	3232.8	10.5 Br,	3234.5	10.5 L,	3246.8	10.6 M,	3256.4	10.7 L,
	3260.8	10.8 Wf,	3265.8	12.2 M.				
023133 R TRIANGULI—								
	3227.8	12.6 Pt.	3236.8<11.6 M,		3264.8	10.2 Pt,	3286.8	9.3 M.
024217 T ARIETIS—								
	2992.0	8.3 Nk,	2994.0	8.3 Nk,	2997.0	8.2 Nk.		
024356 W PERSEI—								
	2997.0	10.3 Nk,	3006.1	9.4 Nk,	3009.9	9.6 Nk,	3221.9	9 2 Br,
	3227.8	9.1 Pt,	3235.9	9.2 Br,	3236.8	9.2 M,	3258.8	9.8 Jb,
	3264.8	9.4 Pt,	3284.8	10.4 M.				
030514 U ARIETIS—								
	3241.6	10.2 Gi,	3255.6	11.4 Gi.				
031401 X CETI—								
	3262.6	9.0 L,	3264.8	8.9 Pt.				
032043 Y PERSEI—								
	3227.8	8.3 Pt,	3262.8	9.5 M,	3264.8	8.3 Pt.		
032335 R PERSEI—								
	3231.6<12.3 Gi,		3244.6	12.3 Gi,	3257.6	11.1 Gi,	3262.8	10.5 M,
	3264.8	9.6 Pt,	3267.5	10.0 Gi.				
033362 U CAMELOPARDALIS—								
	3284.8	8.7 M.						
041619 T TAURI—								
	3286.9	9.8 M.						
042209 R TAURI—								
	3264.8	9.0 Pt,	3286.9	8.6 M.				
042215 W TAURI—								
	3264.8	10.5 Pt,	3286.9	10.0 M.				

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
042309 S TAURI—												
	3264.8	11.6	Pt,	3286.9	10.8	M.						
043065 T CAMELOPARDALIS—												
	3230.4	7.5	L,	3255.4	8.4	L,	3264.8	8.7	Pt,	3284.8	9.4	M.
043208 RX TAURI—												
	3264.8	10.6	Pt.									
043274 X CAMELOPARDALIS—												
	3232.8	8.2	Br,	3252.6	8.3	O,	3264.8	9.6	Pt,	3265.6	8.5	Gd,
	3265.6	9.0	Ya,	3265.6	9.5	O,	3280.6	10.8	O.			
044617 V TAURI—												
	3267.8	11.0	Pt.									
045307 R ORIONIS—												
	3267.6	9.3	Gi.									
050923 R AURIGAE—												
	3267.8	9.5	Pt.									
052034 S AURIGAE—												
	3267.8	8.6	Pt.									
052036 W AURIGAE—												
	3257.6	12.6	Gi.									
052404 S ORIONIS—												
	3286.9	9.4	M.									
053005a T ORIONIS—												
	3286.9	10.2	M.									
053068 S CAMELOPARDALIS—												
	3267.8	10.5	Pt.									
053326 RR TAURI—												
	3286.8	11.0	M.									
053531 U AURIGAE—												
	3267.8	10.1	Pt.									
054319 SU TAURI—												
	3173.1	9.5	Ch,	3189.3	9.5	Jp,	3189.3	9.5	Dp,	3262.6	9.2	L,
	3264.8	9.5	Pt,	3267.8	9.4	Pt,	3286.9	9.6	M.			
054920a U ORIONIS—												
	3267.8	6.5	Pt,	3286.9	6.5	M.						
054974 V CAMELOPARDALIS—												
	3221.8<10.2		Br,	3224.8<13.5		Wf,	3229.4<14.0		Gi,	3232.8<13.5		Wf.
	3235.8<11.6		Br,	3256.5<14.0		Gi,	3262.9<13.5		Wf,	3284.8<12.2		M.
055353 Z AURIGAE—												
	3224.8	10.8	Wf,	3232.8	10.6	Wf,	3241.8	10.1	Pt,	3262 9	9.5	Wf.
	3265.8	9.3	M,	3267.8	9.5	Pt.						
060450 X AURIGAE—												
	3173.1	10.4	Ch,	3267.8	8.7	Pt,	3286.9	8.6	M.			
060547 SS AURIGAE—												
	3172.1	11.0	Ch,	3173.1	11.1	Ch,	3175.1	11.2	Ch,	3207.3<13.0		Jp,
	3207.3<13.0		Dp,	3207.4<13.3		Gi,	3209.3<12.4		Gi,	3210.4<12.4		L.
	3211.3<12.4		Gi,	3216.4<11.7		Gi,	3234.6	10.9	L.	3237.6	10.9	L.
	3239.6	11.0	Gi,	3241.6	11.8	Gi,	3241.8<11.5		Pt,	3244.6<11.7		Gi.
	3255.6<13.8		Gi,	3257.6<13.8		Gi,	3259.6<13.8		Gi,	3261.6<13.3		Gi,
	3262.6<13.3		L,	3262.9<13.0		Wf,	3263.6<13.8		Gi,	3264.8<12.6		Pt.
	3265.6<13.8		Gi,	3267.6<13.9		Gi,	3267.8<12.6		Pt,	3284.8<12.4		Pt,
	3285.7<11.5		Pt,	3286.9<12.4		M.						
061647 V AURIGAE—												
	3286.8	10.0	M.									
063558 S LYNCIS—												
	3267.8	9.6	Pt.									
064030 X GEMINORUM—												
	3207.4	8.9	Gi.									
065355 R LYNCIS—												
	3207.4	8.3	Gi,	3224.8	7.9	Wf,	3229.4	7.8	Gi,	3238.7	7.6	Wf,
	3239.4	8.1	Gi,	3255.6	8.4	Gi,	3262.9	8.3	Wf.			

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
070122a R GEMINORUM—												
	3173.1	<11.5	Ch.									
072708 S CANIS MINORIS—												
	3181.1	8.7	Ch,	3195.1	8.3	Ch,	3206.1	7.8	Ch,	3212.1	7.5	Ch.
073723 S GEMINORUM—												
	3204.6	<10.8	Mi.									
074922 U GEMINORUM—												
	3173.1	9.2	Ch,	3175.1	9.2	Ch.	3179.1	9.7	Ch,	3200.3	<13.3	Jp,
	3200.3	<13.3	Dp,	3201.3	<13.3	Jp,	3201.3	<13.3	Dp,	3205.3	<13.3	Jp,
	3205.3	<13.3	Dp,	3207.3	<13.3	Jp,	3207.3	<13.3	Dp,	3207.4	<12.8	Gi,
	3209.4	<12.6	Gi.									
081112 R CANCRI—												
	3179.1	8.3	Ch,	3198.1	8.7	Ch.						
083019 U CANCRI—												
	3200.3	12.8	Jp,	3200.3	13.0	Dp.						
084803 S HYDRAE—												
	3179.1	7.9	Ch,	3200.1	8.7	Ch.						
084917 X CANCRI—												
	3188.0	6.7	Nk,	3191.0	6.8	Nk,	3196.0	6.8	Nk,	3198.0	6.6	Nk,
	3199.0	6.7	Nk,	3201.0	6.7	Nk,	3204.0	7.1	Nk,	3206.0	6.7	Nk,
	3207.0	6.8	Nk,	3209.0	6.5	Nk,	3213.0	6.6	Nk,	3218.0	6.6	Nk,
	3220.0	6.8	Nk,	3221.0	6.7	Nk.						
085008 T HYDRAE—												
	3181.1	7.5	Ch,	3200.1	8.1	Ch.						
085120 T CANCRI—												
	3188.0	8.9	Nk,	3191.0	8.9	Nk,	3196.0	8.6	Nk,	3198.0	8.2	Nk,
	3199.0	8.1	Nk,	3201.0	8.5	Nk,	3204.0	8.5	Nk,	3206.0	8.6	Nk,
	3207.0	8.8	Nk,	3209.0	9.1	Nk,	3213.0	9.0	Nk,	3218.0	9.1	Nk,
	3220.0	8.6	Nk,	3221.0	8.4	Nk,	3225.0	9.1	Nk.			
090151 V URSAE MAJORIS—												
	3226.7	10.7	Mu.									
093934 R LEONIS MINORIS—												
	3175.2	8.9	Ch,	3200.1	9.8	Ch,	3200.4	9.2	Jp,	3200.4	9.2	Dp,
	3226.7	10.7	Pt,	3227.4	10.8	L,	3235.4	10.7	L.			
094211 R LEONIS—												
	3163.2	9.8	Ch,	3191.2	10.2	Ch,	3200.1	10.1	Ch,	3200.4	9.4	Jp,
	3200.4	9.4	Dp,	3205.3	9.5	Jp,	3205.3	9.4	Dp,	3212.3	9.2	Dp,
	3221.0	9.0	Nk,	3221.8	8.5	Sg,	3226.7	8.9	Pt,	3227.3	9.4	An.
094512 X LEONIS—												
	3198.4	<13.3	L,	3210.4	<12.3	L.						
095421 V LEONIS—												
	3226.7	12.8	Pt.									
103212 U HYDRAE—												
	3195.4	5.4	Pe,	3197.4	5.4	Pe,	3207.0	5.3	Kd.			
103769 R URSAE MAJORIS—												
	3175.2	<11.5	Ch,	3199.1	11.8	Ch,	3205.4	11.8	Jp,	3205.4	11.8	Dp,
	3220.7	10.5	Hj,	3221.8	10.5	Br,	3222.7	10.3	Hj,	3224.8	10.5	Sg,
	3226.7	9.5	Pt,	3226.8	9.8	Sg,	3226.8	10.4	Mu,	3228.2	9.0	Ch,
	3228.7	9.2	Lv,	3232.3	9.1	Jp,	3232.3	9.3	Dp,	3233.6	8.7	Hj,
	3235.7	8.5	Br,	3236.8	8.5	Sg,	3239.2	8.5	Ch,	3241.7	8.1	Hj,
	3244.7	7.8	Hj,	3250.8	7.6	Sg,	3251.6	7.9	Pe,	3252.6	7.6	O.
	3253.7	8.0	Lc,	3255.6	7.5	Hj,	3256.1	7.4	Ch,	3260.6	7.2	Pt,
	3261.6	7.4	Hj,	3262.6	7.4	Cd,	3262.8	7.5	Sg,	3265.6	7.9	Gd,
	3265.6	7.6	Ya,	3265.6	7.7	O,	3272.7	7.5	Sg,	3279.7	7.5	Sg,
	3280.6	8.0	O.									
104620 V HYDRAE—												
	3175.2	9.2	Ch,	3191.1	9.6	Ch,	3198.0	8.8	Nk,	3199.0	9.3	Nk,
	3200.1	10.0	Ch,	3201.0	9.1	Nk,	3206.0	9.5	Nk,	3220.0	8.9	Nk,
104814 W LEONIS—												
	3200.4	12.5	Jp,	3200.4	12.4	Dp,	3233.3	13.0	Jp,	3233.3	12.9	Dp.

VARIABLE STAR OBSERVATIONS. June 20 to August 20, 1922—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.
115905 RX VIRGINIS—								
	3200.4	8.4 Jp,	3200.4	8.5 Dp,	3207.3	8.5 Jp,	3207.3	8.6 Dp,
	3233.3	8.4 Jp,	3233.3	8.5 Dp.				
115919 R COMAE BERENICES—								
	3223.8	8.8 Wf,	3226.7	9.2 Pt,	3228.7	9.2 Lv,	3229.6	8.8 Wl,
	3230.8	8.5 Wf,	3238.8	8.8 Wf,	3257.6	8.9 Cd,	3259.7	9.3 Wf,
	3260.6	9.3 Pt.						
120206 RW VIRGINIS—								
	3200.4	7.3 Jp,	3200.4	7.3 Dp,	3207.4	7.4 Jp,	3207.4	7.3 Dp,
	3233.3	7.5 Jp,	3233.3	7.4 Dp.				
120905 T VIRGINIS—								
	3230.7	12.5 Lv.						
121418 R CORVI—								
	3226.7	10.5 Pt,	3227.4	10.3 L,	3235.4	11.2 L.		
122001 SS VIRGINIS—								
	3206.4	8.7 Au,	3222.4	8.2 Au,	3227.4	7.0 L,	3235.4	7.0 L.
122532 T CANUM VENATICORUM—								
	3201.0	11.4 Nk,	3220.0	10.8 Nk,	3226.7	11.0 Pt,	3229.6	11.1 Wl,
	3231.6	11.0 M,	3231.7	10.5 Br.	3260.6	10.5 Pt.		
122803 Y VIRGINIS—								
	3230.4<13.2 L.							
123160 T URSAE MAJORIS—								
	3193.1<11.5 Ch,		3201.4<12.8 Jp,		3201.4<12.8 Dp,		3205.4	13.1 Jp,
	3205.4	13.0 Dp,	3226.7	12.7 Pc,	3226.7	12.6 Pt,	3229.2	11.8 Ch,
	3229.6	12.7 Wl,	3231.6	12.7 M,	3231.8<11.7 Br,		3233.3	12.6 Jp,
	3233.3	12.7 Dp,	3251.2	11.6 Ch,	3252.6<10.8 Cg,		3255.7<10.8 Hj,	
	3260.6	10.5 Pt,	3262.6	9.8 Cg,	3262.8	9.9 Sg,	3265.7	9.6 Cd.
	3267.6	8.8 Ro,	3280.6	8.2 O,	3281.7	8.0 Sg.		
123307 R VIRGINIS—								
	3180.1	9.5 Ch,	3198.1	8.2 Ch,	3199.0	8.7 Nk,	3200.4	8.3 Jp,
	3200.4	8.4 Dp,	3201.0	8.4 Nk,	3202.4	8.3 Pe,	3204.0	8.4 Nk,
	3205.3	7.6 Jp,	3205.3	7.4 Dp,	3206.0	8.4 Nk,	3206.2	7.7 Ch,
	3208.0	7.7 Nk,	3213.0	7.5 Nk,	3213.2	7.2 Ch,	3217.0	7.3 Nk,
	3218.0	7.1 Nk,	3220.0	7.1 Nk,	3221.0	7.1 Nk,	3222.4	7.7 Jp,
	3222.4	7.6 Dp,	3226.7	7.4 Pt,	3227.4	7.4 L,	3229.0	7.4 Nk,
	3229.2	7.3 Ch,	3232.3	7.8 Jp,	3232.3	7.6 Dp,	3235.4	7.4 L,
	3246.1	8.7 Ch,	3253.1	9.3 Ch,	3257.4	9.8 L,	3260.6	10.0 Pt.
	3261.6	10.0 O,	3267.3	8.8 Ro.				
123459 RS URSAE MAJORIS—								
	3180.1	9.0 Ch,	3191.6	8.6 Mi,	3199.1	8.8 Ch,	3223.8	8.9 Wf,
	3226.7	9.6 Pc,	3226.7	9.1 Pt,	3228.7	9.4 Lv,	3229.2	9.6 Ch,
	3229.6	9.5 Wl,	3230.8	9.3 Wf,	3231.6	9.8 M,	3235.7	9.8 Br,
	3236.8	10.0 Sg,	3238.8	9.5 Wf,	3239.2	9.9 Ch,	3250.8	10.8 Sg,
	3252.6	10.8 Cg,	3253.1	10.2 Ch,	3255.7	10.6 Hj,	3258.7	11.0 Wf,
	3260.6	11.1 Pt,	3262.6	10.2 Cg,	3262.7	11.2 Sg,	3266.7	11.0 Wf,
	3281.7<10.8 Sg,		3282.6	10.0 Cg.				
123961 S URSAE MAJORIS—								
	3180.1	9.0 Ch,	3193.1	9.8 Ch,	3198.6<10.1 Mi,		3199.1	10.4 Ch,
	3201.4	9.9 Dp,	3201.4	10.0 Jp,	3205:4	10.4 Jp,	3205.4	10.4 Dp,
	3226.7	11.5 Pt,	3226.7	11.3 Pc,	3229.2	11.5 Ch,	3229.6	11.8 Wl,
	3230.4	11.4 L,	3231.6	11.5 M,	3231.6	12.0 Ro,	3232.6<11.1 Su,	
	3232.8	11.7 Br,	3233.3	11.6 Jp,	3233.3	11.5 Dp,	3233.4	11.5 Pc,
	3236.8<10.1 Sg,		3237.6	11.7 L,	3250.8<10.8 Sg,		3252.6<10.1 Cg,	
	3253.1<11.1 Ch,		3260.6	11.4 Pt,	3262.6<10.1 Cg,		3262.8<10.1 Sg,	
	3280.6	9.4 O,	3281.6	9.0 Cg.	3281.7	9.5 Sg.		
124606 U VIRGINIS—								
	3201.4	8.9 Jp,	3201.4	8.9 Dp,	3226.7	8.5 Pt,	3232.3	8.4 Jp.
	3232.3	8.6 Dp.	3260.6	8.4 Pt.				
130212 RV VIRGINIS—								
	3230.8<13.6 Wf.							

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
132422 R HYDRAE—												
	3180.2	8.4	Ch,	3205.0	9.2	Kd,	3206.1	9.1	Ch,	3211.0	9.3	Kd,
	3217.0	9.5	Kd,	3226.0	9.7	Kd,	3226.7	9.2	Pt,	3227.4	9.1	Gi,
	3227.4	9.3	L,	3235.4	9.5	L,	3237.1	9.7	Ch,	3242.0	9.8	Kd,
	3244.4	9.1	Gi,	3251.1	9.8	Ch.						
132706 S VIRGINIS—												
	3191.1	9.2	Ch,	3205.1	9.5	Ch,	3223.8	10.6	Wf,	3224.7	<10.0	Sg,
	3226.7	10.6	Pt,	3229.2	10.7	Ch,	3229.6	11.7	Wl,	3230.8	10.8	Wf,
	3245.7	<9.4	Sg,	3252.1	12.1	Ch,	3260.6	12.0	Pt.			
133273 T URSAE MINORIS—												
	3223.8	11.8	Wf,	3226.8	11.5	Lv,	3230.7	11.6	Lv,	3230.8	11.5	Wf,
	3232.7	11.2	Br,	3238.8	11.4	Wf,	3259.7	9.9	Wf,	3266.8	9.0	Wf.
133633 T CENTAURI—												
	3199.0	8.4	Kd,	3201.0	8.4	Kd,	3205.0	8.3	Kd,	3217.0	6.7	Kd,
	3221.0	6.4	Kd,	3223.0	6.3	Kd,	3225.0	6.2	Kd,	3229.0	6.1	Kd.
	3236.0	6.0	Kd,	3242.0	6.1	Kd,	3252.0	6.4	Kd,	3255.0	6.5	Kd,
	3256.0	6.5	Kd,	3257.0	6.6	Kd.						
134440 R CANUM VENATICORUM—												
	3205.4	8.6	Jp,	3205.4	8.7	Dp,	3226.7	9.3	Pt,	3228.7	9.8	Lv,
	3231.7	10.0	M,	3232.4	9.4	Jp,	3232.4	9.5	Dp,	3260.6	10.4	Pt,
	3265.7	<10.2	Cg,	3282.6	10.4	Cg.						
140113 Z BOOTIS—												
	3223.8	13.5	Wf,	3230.8	13.9	Wf,	3231.7	<12.5	M,	3238.8	<12.5	Wf,
	3259.8	<14.0	Wf.									
140512 Z VIRGINIS—												
	3226.7	10.2	Pt,	3260.6	10.8	Pt.						
141567 U URSAE MINORIS—												
	3180.1	7.6	Ch,	3193.1	7.8	Ch,	3205.1	8.3	Ch,	3206.4	8.7	Au,
	3222.3	9.4	Au,	3226.7	9.2	Lv,	3226.7	9.1	Pt,	3227.6	9.0	Pw,
	3228.3	9.3	Ch,	3230.7	9.3	Lv,	3231.6	9.8	M,	3231.6	9.2	Pw,
	3241.7	10.0	Hj,	3242.4	10.2	Au,	3246.4	10.0	Au,	3248.6	10.3	Pw,
	3255.7	10.7	Hj,	3256.1	10.6	Ch,	3256.4	10.2	Au,	3258.6	10.7	Pw,
	3260.6	10.6	Pt,	3263.4	10.5	Au,	3265.6	10.9	Pw,	3265.7	11.0	Hj,
	3281.6	11.3	Ya,	3282.7	10.8	Cg.						
141954 S BOOTIS—												
	3188.1	10.5	Ch,	3198.1	10.2	Ch,	3205.1	9.8	Ch,	3214.1	9.4	Ch,
	3220.5	8.9	Gi,	3226.7	8.7	Pt,	3230.4	8.3	L,	3231.6	8.4	Ro,
	3233.4	8.5	Gi,	3233.4	8.4	L,	3238.2	8.5	Ch,	3244.5	8.5	Gi,
	3245.2	8.4	Ch,	3255.1	8.3	Ch,	3257.4	8.0	L,	3259.4	8.4	Gi,
	3260.6	8.1	Pt,	3261.7	8.0	Sg,	3280.8	8.4	Sg,	3281.6	8.3	Ya,
	3282.6	8.7	Gd.									
142539 V BOOTIS—												
	3153.4	7.0	L,	3162.7	7.5	Mu,	3213.0	8.7	Nk,	3214.2	8.8	Ch,
	3217.0	8.9	Nk,	3217.8	9.1	Hj,	3220.0	9.0	Nk,	3221.0	8.8	Nk,
	3222.7	9.3	Hj,	3226.7	9.4	Pt,	3229.8	9.6	Hj,	3230.4	10.0	L,
	3231.6	9.0	M,	3231.6	9.4	Ro,	3233.7	9.8	Hj,	3236.8	10.0	Sg,
	3238.3	9.8	Ch,	3240.7	9.9	Hj,	3245.2	10.3	Ch,	3250.8	10.4	Sg,
	3252.5	10.2	L,	3254.6	10.4	Hj,	3259.6	10.0	M,	3260.6	10.9	Pt,
	3261.6	10.5	Hj,	3262.8	11.0	Sg,	3276.6	10.5	B,	3280.7	10.3	Su,
	3288.6	<9.2	Mc.									
142584 R CAMELOPARDALIS—												
	3201.4	7.5	Jp,	3201.4	7.7	Dp,	3205.4	8.2	Jp,	3205.4	8.2	Dp,
	3215.4	8.2	Gi,	3223.8	8.3	Wf,	3226.7	8.0	Pt,	3229.2	8.2	Ch,
	3230.8	8.3	Wf,	3231.7	8.3	M,	3233.3	8.2	Jp,	3233.3	8.1	Dp,
	3234.5	8.3	Gi,	3235.8	8.5	Br,	3238.8	8.4	Wf,	3246.5	8.7	Gi,
	3252.6	9.0	O,	3259.7	9.0	Wf,	3260.7	8.8	Pt,	3262.4	8.9	Gi,
	3265.6	9.5	O,	3265.6	9.4	Gd,	3265.6	9.4	Ya,	3266.8	9.2	Wf,
	3280.6	10.5	O.									

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.
143227 R BOOTIS—								
	3188.1	12.1 Ch,	3198.1	11.6 Ch,	3226.7	9.5 Pt,	3227.8	9.5 M.
	3229.2	9.3 Ch,	3236.8	8.8 Sg,	3238.2	8.7 Ch,	3245.2	8.6 Ch,
	3250.8	8.0 Sg,	3257.6	7.2 O,	3259.6	7.9 M,	3260.7	7.1 Pt,
	3262.8	7.0 Sg,	3265.6	7.2 Ya,	3265.6	7.5 Gd,	3265.6	7.3 O,
	3280.6	7.2 O,	3280.7	7.0 Su.				
144918 U BOOTIS—								
	3220.5	11.5 Gi,	3233.4	11.5 Gi,	3245.6 3259.6	<11.5 M, 10.8 M,	3247.4	11.4 Gi,
	3251.7	<11.4 M,	3258.4	11.0 Gi,			3280.6	9.7 V.
150018 RT LIBRAE—								
	3260.4	<13.0 Bp.	3261.4	<13.0 Bp.				
150519 T LIBRAE—								
	3249.6	12.5 Pt,	3260.7	11.3 Pt.				
150605 Y LIBRAE—								
	3227.4	13.4 L,	3235.4	13.3 L,	3257.4	13.5 L.		
151520 S LIBRAE—								
	3193.1	8.5 Ch,	3227.4	9.6 L,	3249.6	10.6 Pt,	3252.4	10.6 L.
	3256.1	10.6 Ch,	3260.7	11.0 Pt.				
151714 S SERPENTIS—								
	3227.4	11.7 L,	3230.8	11.9 Wf,	3237.6	11.5 L,	3238.8	11.5 Wf.
	3259.7	8.8 Wf,	3266.8	8.3 Wf.				
151731 S CORONAE BOREALIS—								
	3188.1	10.7 Ch,	3198.1	11.4 Ch,	3220.0	12.1 Nk,	3227.8	12.4 M.
	3230.8	12.0 Wf,	3231.8	12.0 Br,	3232.6	<11.1 Su.	3236.1	12.4 Nk.
	3236.8	10.5 Sg,	3238.8	12.3 Wf,	3249.6	12.5 Pt,	3250.9	10.2 Sg.
	3251.2	<11.5 Ch,	3259.8	12.9 Wf,	3260.7	12.3 Pt,	3262.7	11.8 Sg.
	3265.6	<10.3 Su,	3266.8	13.9 Wf,	3279.8	11.8 Sg.	3281.6	12.6 B.
151822 RS LIBRAE—								
	3227.4	9.5 L,	3235.4	9.7 L,	3257.4	10.7 L.		
152714 RU LIBRAE—								
	3226.7	8.5 Mu,	3227.4	8.6 L,	3235.4	8.6 L,	3236.8	8.5 Sg.
	3249.6	8.8 Pt,	3257.4	9.3 L,	3258.7	9.4 Sg.	3260.7	9.7 Pt.
	3279.7	10.5 Sg.						
153215 W LIBRAE—								
	3236.8	<10.2 Sg.	3258.7	<10.2 Sg,	3279.7	<10.2 Sg.		
153378 S URSAE MINORIS—								
	3223.8	8.3 Wf,	3230.8	8.3 Wf,	3231.6	8.2 Ro,	3232.6	8.6 Su,
	3238.8	8.2 Wf,	3245.6	8.7 M,	3249.6	8.2 Pt,	3259.6	8.3 M.
	3259.7	8.2 Wf,	3260.7	8.2 Pt,	3265.6	8.4 Su,	3266.8	8.4 Wf.
	3280.6	8.6 V.						
154428 R CORONAE BOREALIS—								
	3188.0	5.8 Nk,	3188.1	6.2 Ch,	3191.0	5.6 Nk,	3191.6	6.4 Cs.
	3191.6	6.3 Hs,	3195.0	6.0 Kd,	3195.4	6.0 Pe,	3196.0	5.5 Nk.
	3197.6	6.0 Hs,	3198.0	5.6 Nk,	3198.1	6.3 Ch,	3198.4	6.0 Pe.
	3198.6	6.3 Hs,	3198.6	6.4 Cs,	3199.0	5.6 Nk,	3201.0	5.6 Nk,
	3202.0	6.1 Kd,	3204.0	5.5 Nk,	3206.0	5.7 Nk,	3207.4	6.3 L.
	3209.0	6.3 Nk,	3209.6	6.4 Ra,	3217.0	6.3 Nk,	3217.8	6.4 Hj.
	3218.0	6.3 Nk,	3218.7	6.6 Hj,	3219.0	6.1 Kd,	3219.0	6.2 Nk.
	3220.0	6.2 Nk,	3220.7	6.4 Hj,	3220.7	6.1 Mu,	3220.8	6.1 Wf.
	3221.0	6.2 Nk,	3221.8	6.0 Mu,	3222.4	6.2 L,	3223.7	6.0 Mu.
	3223.9	6.1 Wf,	3224.1	6.1 Nk,	3224.7	6.0 Mu,	3225.0	6.0 Kd.
	3225.6	5.9 Pc,	3225.7	6.0 Mu,	3226.1	6.1 Nk,	3226.7	6.0 Mu.
	3226.7	6.2 Pt,	3226.8	6.0 Sg,	3227.4	6.2 L,	3227.4	6.4 An.
	3227.5	6.2 Gi,	3227.6	6.0 Pw,	3227.8	6.2 Pt,	3227.8	6.3 M.
	3227.8	6.3 Mu,	3227.8	6.1 Wf,	3228.6	6.2 O,	3228.6	6.1 Su.
	3228.7	6.2 Pt,	3228.7	6.1 To,	3228.8	6.2 Mu,	3229.1	6.2 Nk.
	3229.4	6.3 Au,	3229.7	6.3 Pt,	3229.7	6.1 Mu,	3229.8	6.3 Hj.
	3230.0	6.3 Nk,	3230.4	6.1 L,	3230.7	6.3 Mu,	3230.8	6.1 Wf.
	3231.7	6.1 Mu,	3231.7	6.3 Pt,	3231.7	6.1 Pc,	3232.6	6.1 Su.
	3232.7	6.2 Mu,	3232.8	6.1 Wf,	3233.7	6.3 Hj,	3233.7	6.2 Mu.
	3233.8	6.3 Pt,	3234.6	6.1 L,	3234.7	6.1 To,	3234.7	6.3 Mu.

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
154428 R CORONAE BOREALIS—Continued												
	3235.0	5.9	Nk,	3235.4	6.2	L,	3235.4	6.1	Pe,	3235.7	6.2	Pt,
	3235.8	6.3	Hj,	3236.0	5.9	Nk,	3236.6	6.7	Cl,	3236.8	6.0	Sg,
	3237.6	6.2	L,	3238.2	6.1	Ch,	3238.8	6.2	Wf,	3239.5	6.3	Gi,
	3240.8	6.2	Pt,	3240.8	6.1	Wf,	3241.7	6.3	Hj,	3241.8	6 1	Pt,
	3243.7	6.2	Pt,	3244.7	6.3	Pt,	3245.6	6.3	M,	3245 8	6.0	Sg,
	3246.7	6.1	Jb,	3247.0	6.4	Kd,	3247.6	6.7	Cl,	3247.7	6.2	To,
	3248.4	6.4	An,	3248.7	6.2	Jb,	3249.4	6.1	An,	3249.4	6.3	Gi,
	3249.6	6.3	Pt,	3249.6	6.1	Su,	3250.6	6.5	Ra,	3250.6	6 3	Pt,
	3250.9	6.2	Sg,	3251.2	6.0	Ch,	3251.6	6.1	Pt,	3251 6	6.2	Pe,
	3251.6	6.2	M,	3252.0	6.4	Kd,	3252.4	6.3	L,	3252.6	6.4	Cg,
	3252.6	6.5	O,	3252.7	6.2	Lc,	3253.4	6.3	An,	3253.7	6.3	Lc,
	3254.0	6.4	Kd,	3254.4	6.3	An,	3254.6	6.3	Pt,	3254.7	6 3	Hj,
	3255.4	6.3	L,	3255.6	6.3	Pt,	3255.6	6.6	Su,	3255.7	6.1	Jb,
	3255.7	6.3	Hj,	3256.0	6.2	Kd,	3256.4	6.4	L,	3256.4	6.3	An,
	3256.6	6.5	Ra,	3256.7	6.2	Pt,	3257.1	6.3	Kd,	3257.4	6.4	L,
	3257.6	6.7	Cg,	3257.6	6.7	O,	3257.7	6.1	Pt,	3257.8	6.6	Cd,
	3258.4	6.5	Gi,	3258.7	6.2	Pt,	3258.8	6.2	Sg,	3259.6	6.3	M,
	3259.7	6.3	Pt,	3259.8	6.7	Wf,	3260.7	6.4	Pt,	3260.8	6.8	Wf,
	3261.4	6.5	L,	3261.6	6.7	O,	3261.7	6.3	Pt,	3262.4	6.4	An,
	3262.5	6.6	L,	3262.6	6.7	Cg,	3262.8	6.0	To,	3262.8	6.0	Sg,
	3262.8	6.8	Wf,	3263.6	6.4	Pt,	3263.7	6.7	Wf,	3264.6	7.0	Cg,
	3264.8	6.5	Pt,	3264.8	6.9	Wf,	3265.4	6.5	An,	3265.6	6.8	O,
	3265.6	7.0	Gd,	3265.6	6.9	Gd,	3265.7	7.0	Cg,	3265.7	6.8	Jb,
	3265.7	6.7	Su,	3265.8	6.9	Wf,	3266.6	6.9	O,	3266.6	6.4	M,
	3266.7	6.9	Wf,	3267.6	6.6	Pt,	3268.6	6.5	Pt,	3271.6	6.5	Pt,
	3272.7	6.0	Sg,	3273.7	6.7	Wf,	3274.7	6.5	Wf,	3276.6	6.5	Pt,
	3277.7	6.5	Pt,	3278.6	6.5	Pt,	3279.7	6.5	Pt,	3279.7	6.2	Sg,
	3280.6	6.2	M,	3280.6	6.2	Su,	3280.6	6.5	Cg,	3280.6	6.5	V,
	3280.6	7.5	O,	3280.7	6.4	Pt,	3281.6	6.5	Ya,	3281.6	6.2	Su,
	3281.7	6.3	Pt,	3282.6	6.6	Cg,	3282.6	6.7	Cd,	3282.6	7.0	Gd,
	3282.7	6.5	Pt,	3283.6	6.6	Su,	3283.7	6.6	Cg,	3284.6	6.4	Pt,
	3285.5	6.5	Em,	3285.6	6.3	Pt,	3289.5	6.9	Cl,			
154536 X CORONAE BOREALIS—												
	3228.8	10.0	M,	3230.8	10.2	Wf,	3238.8	10.6	Wf,	3249.6	11.3	Pt,
	3259.8	11.8	Wf,	3260.7	11.7	Pt,	3266.7	12.2	Wf,	3276.6	12.3	B,
154615 R SERPENTIS—												
	3183.2	8.5	Ch,	3193.1	8.8	Ch,	3198.4	9.5	Pe,	3203.6	9.0	Su,
	3206.1	9.8	Ch,	3224.7	10.3	Sg,	3235.4	11.0	Pe,	3245.6	11.2	M,
	3247.8	11.1	Sg,	3249.6	10.9	Pt,	3260.7	11.5	Pt,	3260.8	12.0	Sg,
154639 V CORONAE BOREALIS—												
	3227.8	9.7	M,	3230.8	9.9	Wf,	3231.8	9.8	Br,	3238.8	9.0	Wf,
	3249.6	8.8	Pt,	3259.6	9.5	M,	3259.8	8.9	Wf,	3260.4	8.7	Bp,
	3260.4	8.2	Au,	3260.7	8.2	Pt,	3266.7	8.7	Wf,	3276.7	8.3	B,
	3282.6	9.0	Gd.									
154715 R LIBRAE—												
	3198.0<12.0 Nk,			3199.0<12.5 Nk,			3201.0<12.7 Nk,			3204.0<12.0 Nk,		
	3221.0<13.1 Nk,			3229.0<13.1 Nk,			3249.6	10.3	Pt,	3260.7	9.9	Pt,
	3279.6	10.2	B.									
155018 RR LIBRAE—												
	3190.2<11.9 Ch,			3196.2	12.2	Ch,	3221.2	11.0	Ch,	3227.4	9.4	L,
	3228.2	9.1	Ch,	3239.2	8.9	Ch,	3249.6	8.6	Pt,	3252.4	9.2	L,
	3253.1	9.1	Ch,	3260.7	9.0	Pt.						
155229 Z CORONAE BOREALIS—												
	3228.8	11.0	M,	3281.7<13.0 B.								
155823 RZ SCORPII—												
	3250.6	12.0	Pt,	3260.7	11.8	Pt.						
160021 Z SCORPII—												
	3227.4	12.3	L,	3249.7<12.0 Fn,			3252.4	12.1	L,	3255.7	12.	Fn.

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
160118 R HERCULIS—												
	3183.2	9.4	Ch,	3206.1	9.7	Ch,	3225.8	11.1	Sg,	3227.8	12.0	M,
	3245.7 3276.8	<10.3	Sg. <10.7 Sg.	3250.6	12.5	Pt.	3258.8	<10.7	Sg.	3260.7	13.4	Pt,
160150 RR HERCULIS—												
	3213.0	8.3	Nk,	3221.1	8.8	Nk,	3229.0	9.4	Nk.			
160210 U SERPENTIS—												
	3199.0	<12.3	Nk,	3201.0	<12.3	Nk,	3204.0	<12.3	Nk,	3206.0	<12.3	Nk,
	3209.1	<12.0	Nk.	3221.8	<12.0	Br,	3224.7	<10.6	Sg,	3227.6	<11.0	Pw,
	3228.6	<11.4	Pw,	3232.8	<11.4	Br,	3245.6	11.3	M,	3247.8	11.5	Sg,
	3250.6	11.3	Pt,	3260.7	10.0	Pt,	3260.8	9.8	Sg,	3261.6	9.8	O,
	3283.6	9.0	Cg,	3288.6	<9.3	Mc,	3289.6	9.9	Cl.			
160519 W SCORPII—												
	3178.6	14.2	Pa,	3206.6	13.9	Pa.	3227.6	13.0	Pa,	3255.6	12.9	Pa.
160625 RU HERCULIS—												
	3230.8	12.9	Wf,	3231.6	13.3	Pc,	3238.8	13.0	Wf,	3250.6	13.4	Pt.
	3259 8	13.0	Wf.	3260.7	14.1	Pt,	3266.8	13.5	Wf.			
160625b SX HERCULIS—												
	3255.6	8.2	Pt,	3257.7	8.3	Pt,	3260.7	8.5	Pt,	3260.8	8.5	Wf,
	3262.8	8.6	Wf,	3263.6	8.3	Pt,	3263.7	8.5	Wf,	3264.8	8.6	Wf,
	3265.8	8.7	Wf,	3266.7	8.6	Wf,	3267.6	9.2	Pt,	3273.7	8.7	Wf,
	3276.6	8.8	Pt,	3278.6	9.2	Pt,	3280.7	9.0	Pt,	3285.6	8.7	Pt.
161122a R SCORPII—												
	3201.4	11.3	Jp,	3201.4	11.3	Dp,	3233.4	10.8	Jp.	3233.4	10 9	Dp,
	3251.7	12.0	Pt.	3263.6	12.4	Pt.						
161122b S SCORPII—												
	3201.4	<12.6	Jp,	3201.4	<12.6	Dp,	3206.6	14.4	Pa,	3227.6	15.1	Pa,
	3233.4	<12.6	Jp.	3233.4	<12.6	Dp,	3248.6	<15.0	Pa.			
161122c T SCORPII—												
	3251.7	11.0	Pt,	3263.6	11.2	Pt.						
161138 W CORONAE BOREALIS—												
	3228.8	9.0	M,	3230.8	9.2	Wf,	3232.8	9 3	Br,	3235.8	9.3	Hj,
	3238.8	9.4	Wf,	3241.7	9.6	Hj,	3251.7	9.9	Pt,	3252.6	9.5	M,
	3254.7	10.6	Hj,	3257.8	10.3	Cd,	3259.6	10.4	M,	3259.8	10.8	Wf,
	3263.6	10.5	Pt,	3266.8	11.1	Wf,	3282.6	10.3	Gd.			
161607 W OPHIUCHI—												
	3190.2	<11.4	Ch,	3227.4	12.3	L,	3233.4	12.4	L,	3237.1	<11.0	Ch.
	3251.7	13.4	Pt,	3255.4	<12.5	L.	3263.6	13.8	Pt.			
162112 V OPHIUCHI—												
	3190.2	10.5	Ch.	3248.1	9.8	Ch,	3251.7	9.0	Pt,	3263.6	8.0	Pt,
162119 U HERCULIS—												
	3183.2	9.6	Ch,	3197.4	10.0	Pe,	3206.1	10.3	Ch,	3211.4	10.0	Gi,
	3230.8	10.9	Wf,	3231.6	11.1	Pc,	3233.7	10.7	Br,	3234.4	10.4	Gi,
	3235.4	11.0	Pe,	3238.8	10.7	Wf,	3245.7	<10.4	Sg,	3245.6	11.3	M,
	3247.4	10.7	Gi,	3251.7	11.4	Pt,	3258.8	<10.9	Sg,	3259.7	10.7	M,
	3259.8	11.5	Wf,	3261.4	11.1	Gi,	3263.6	11.5	Pt,	3266.8	11.6	Wf,
	3276.8	<10.9	Sg,	3280.6	<10.9	V,	3280.6	<11.0	Su,	3281.7	11.9	B,
	3283.7	<9.8	Ct.	3287.8	<9.3	Ct.						
162319 Y SCORPII—												
	3178.6	<13.0	Pa,	3206.6	15.	Pa,	3227.4	14.2	Gi,	3227.6	14.7	Pa,
	3233.4	13.5	L,	3248.6	14.1	Pa,	3249.4	14.0	Gi,	3255.6	13.5	Pa,
	3256.4	13.4	L,	3261.4	13.3	Gi,	3279.6	11.4	B.			
162807 SS HERCULIS—												
	3205.4	9.7	Jp,	3205.4	9.5	Dp,	3207.6	9.3	L,	3228.5	9.5	L,
	3232.4	9.3	Jp,	3232.4	9.4	Dp,	3236.6	10.6	Cl,	3237.5	10.1	L,
	3251.7	11.6	Pt,	3252.4	11.7	L,	3263.6	11.9	Pt,	3283.7	<10.4	Ct,
	3287.8	10.6	Ct,	3289.6	10.6	Cl.						
162815 T OPHIUCHI—												
	3230.4	11.7	L,	3250.6	<11.9	Cd,	3255.4	12 5	L.			
162816 S OPHIUCHI—												
	3230.4	<13.5	L,	3235.4	<14.3	L.						

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
163137 W HERCULIS—												
	3180.2	8.3	Ch,	3188.1	8.2	Ch,	3198.1	8.3	Ch.	3233.7	10.0	Br,
	3245.6	10.4	M,	3251.7	11.4	Pt,	3263.6	11.7	Pt,	3280.6	<11.2	V.
163172 R URSAE MINORIS—												
	3245.6	9.4	M.									
163266 R DRACONIS—												
	3183.2	7.9	Ch,	3193.2	8.2	Ch,	3206.1	9.6	Ch,	3228.2	11.0	Ch,
	3236.6	11.6	Wl,	3242.7	<9.8	Hj,	3245.6	11.5	M,	3251.2	<12.0	Ch,
	3251.7	12.2	Pt,	3263.7	12.6	Pt,	3265.7	<9.8	Hj.			
164055 S DRACONIS—												
	3245.7	8.6	M.									
164319 RR OPHIUCHI—												
	3228.6	11.5	Pc,	3230.4	11.8	L,	3255.4	10.6	L,	3267.6	9.5	B.
164715 S HERCULIS—												
	3190.2	11.0	Ch,	3211.4	11.8	Gi,	3221.8	12.0	Br,	3228.7	10.8	To.
	3229.4	11.8	Gi,	3231.6	11.8	Pc,	3232.8	12.0	Br,	3247.4	11.8	Gi.
	3251.7	11.5	Pt,	3252.7	11.8	M,	3259.7	<12.0	M,	3261.4	11.3	Gi.
	3263.7	12.0	Pt,	3281.7	10.5	B,	3283.6	<8.8	Cg.			
165202 SS OPHIUCHI—												
	3251.7	8.9	Pt,	3263.7	8.9	Pt.						
165631 RV HERCULIS—												
	3226.8	12.4	Lv,	3227.8	12.7	M,	3234.8	13.3	Lv,	3245.7	9.9	Sg.
	3251.6	14.2	Pt,	3258.8	<11.8	Sg,	3266.6	14.0	M,	3276.8	<11.2	Sg.
170215 R OPHIUCHI—												
	3194.2	11.9	Ch,	3228.6	12.6	Pc,	3234.7	12.9	Fn,	3252.7	<10.7	Lc,
	3279.7	<10.7	Sg.	3280.7	<8.2	Ct,	3287.8	<9.5	Ct.			
170627 RT HERCULIS—												
	3221.8	<12.4	Br,	3227.8	14.5	Wf,	3227.8	<13.7	Br,	3228.8	13.0	M,
	3250.6	<13.0	Wl,	3259.8	<13.0	Wf,	3266.8	<14.0	Wf.			
171401 Z OPHIUCHI—												
	3201.4	9.9	Jp,	3201.4	10.0	Dp,	3207.4	10.7	Gi,	3221.8	11.0	Br,
	3231.6	11.4	Gi,	3232.4	11.4	Jp,	3232.4	11.4	Dp,	3232.8	11.5	Br,
	3247.4	11.7	Gi,	3251.6	12.5	Pt,	3251.7	12.0	To,	3261.4	12.0	Gi,
	3261.7	12.3	To,	3263.7	12.5	Pt,	3281.6	<11.2	V,	3289.6	11.7	Cl.
171723 RS HERCULIS—												
	3196.0	8.0	Nk,	3198.0	7.9	Nk,	3199.0	7.9	Nk,	3201.0	7.8	Nk,
	3204.0	7.9	Nk,	3205.4	7.8	Jp,	3205.4	7.7	Dp,	3206.0	7.9	Nk,
	3208.0	8.0	Nk,	3213.0	8.2	Nk,	3214.0	8.3	Nk,	3217.0	8.7	Nk,
	3218.0	8.6	Nk,	3220.0	8.7	Nk,	3225.0	8.9	Nk,	3226.0	9.0	Nk,
	3230.8	9.5	Wf,	3233.4	9.4	Jp,	3233.4	9.4	Dp,	3235.0	9.0	Nk,
	3236.1	9.4	Nk,	3238.8	8.9	Wf,	3245.7	10.5	M,	3250.6	11.1	Wl,
	3251.6	10.0	Pt,	3259.8	11.2	Wf,	3266.8	11.9	Wf,	3281.7	12.4	B,
	3281.7	14.2	Pt.									
172809 RU OPHIUCHI—												
	3205.4	11.0	Jp,	3205.4	10.8	Dp,	3228.7	9.6	To,	3229.8	8.8	M,
	3232.4	9.5	Jp,	3232.4	9.4	Dp,	3234.7	9.6	To,	3247.7	9.5	To,
	3250.7	9.5	Wl,	3251.6	9.7	Pe,	3251.8	9.5	M,	3255.7	9.9	To,
	3261.7	10.0	To,	3265.7	10.0	To,	3281.7	11.0	Pt.			
173212 RT SERPENTIS—												
	3230.4	9.5	L,	3237.5	9.4	L.						
174406 RS OPHIUCHI—												
	3251.6	11.0	Pt,	3281.7	11.1	Pt.						
175111 RT OPHIUCHI—												
	3205.4	12.8	Jp,	3205.4	12 9	Dp,	3228.8	<12.4	To,	3233.4	<12.7	Jp,
	3233.4	<12.7	Dp,	3235.8	<12.0	To,	3247.7	<12.1	To.	3250.6	<13.0	Wl.
	3256.7	<12.0	To.									
175458a T DRACONIS—												
	3193.2	11.2	Ch,	3207.4	10.1	Gi,	3229.4	9.9	Gi,	3232.8	9.6	Br.
	3236.6	11.2	Wl,	3241.6	9.8	Gi,	3248.2	10.2	Ch.	3259.6	9.7	Gi.
175458b UY DRACONIS—												
	3193.2	11.2	Ch,	3232.8	11.5	Br,	3236.6	11.1	Wl.	3248.2	10.2	Ch.

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
175519 RY HERCULIS—												
	3194.2	<11.7	Ch,	3195.4	<11.7	Pe,	3205.4	13.5	Jp,	3205.4	13.6	Dp,
	3221.8	<12.1	Br,	3226.8	13.7	Lv,	3229.1	<12.1	Ch,	3232.4	13.2	Jp,
	3232.4	13.1	Dp,	3232.8	<12.1	Br,	3234.8	13.3	Lv,	3248.7	11.9	To,
	3250.6	11.8	Wl,	3251.6	11.2	Pt,	3252.6	11.8	Wl,	3256.7	11.5	To,
	3261.7	11.0	To,	3265.7	11.2	To,	3281.7	10.1	Pt,	3281.7	10.0	B.
175654 V DRACONIS—												
	3206.4	<13.4	Jp,	3206.4	<13.4	Dp,	3233.4	11.9	Jp,	3233.4	11.8	Dp,
	3236.7	12.1	Wl.									
180531 T HERCULIS—												
	3180.2	8.3	Ch,	3194.2	8.0	Ch,	3198.4	8.5	Pe,	3201.2	8.2	Ch,
	3205.4	8.6	Jp,	3205.4	8.5	Dp,	3227.6	9.6	Pw,	3228.6	8.9	L,
	3229.1	9.4	Ch,	3232.4	9.5	Jp,	3232.4	9.6	Dp,	3233.8	9.5	Br,
	3237.6	9.8	L,	3238.6	9.9	Cd,	3240.1	10.4	Ch,	3245.6	10.5	M,
	3248.6	11.0	Pw,	3248.7	10.8	To,	3251.6	10.5	Pe,	3251.6	11.3	Pt,
	3251.8	11.2	Sg,	3262.6	12.4	L,	3262.7	12.0	To,	3263.8	11.8	Sg,
	3280.6	<11.0	Su,	3280.8	<11.0	Sg,	3281.7	<11.2	V,	3281.7	12.7	Pt,
	3283.7	<9.8	Ct,	3287.8	<10.4	Ct.						
180565 W DRACONIS—												
	3206.4	10.4	Jp,	3206.4	10.2	Dp,	3221.8	9.6	Br,	3226.5	10.0	Lv,
	3228.8	10.0	M,	3233.4	10.1	Jp,	3233.4	9.9	Dp,	3233.8	10.1	Br,
	3236.6	10.1	Wl,	3251.6	10.3	Pt,	3281.7	11.7	Pt.			
180666 X DRACONIS—												
	3206.4	<13.4	Jp.	3206.4	<13.4	Dp.	3226.8	13.8	Lv.	3228.8	<11.3	M,
	3233.4	<13.0	Jp,	3233.4	<13.0	Dp,	3236.6	11.1	Wl.			
180911 NOVA OPHIUCHI 24—												
	3231.6	12.1	Gi,	3233.4	12.0	L,	3251.6	12.8	Pt,	3256.4	12.2	L,
	3257.5	12.6	Gi,	3281.7	13.0	Pt.						
181031 TV HERCULIS—												
	3198.4	<11.6	Pe,	3232.5	<14.5	L.						
181103 RY OPHIUCHI—												
	3220.5	9.5	Gi,	3220.7	9.8	Pt,	3221.8	9.2	Br,	3226.8	9.0	Lv,
	3230.8	8.1	Wf,	3234.4	8.3	Gi,	3234.8	8.2	Lv,	3238.8	7.9	Wf,
	3246.4	8.1	Gi,	3250.7	8.5	Wl,	3251.6	8.5	Pt,	3258.4	8.5	Gi,
	3259.7	9.2	M,	3259.8	8.9	Wf,	3266.8	9.4	Wf,	3281.7	11.0	Pt.
181136 W LYRAE—												
	3198.4	10.3	Pe,	3218.7	9.4	Hj,	3220.7	9.2	Hj,	3225.8	8.9	Hj,
	3226.7	10.0	Mu,	3228.8	8.9	Hj,	3230.4	9.4	L,	3230.8	8.9	Wf,
	3231.7	9.0	M,	3235.6	9.1	Wl,	3237.6	8.9	L,	3237.7	8.9	Hj,
	3238.8	8.6	Wf,	3245.7	8.2	Sg,	3251.7	8.7	Pt,	3259.7	8.2	Hj,
	3259.8	8.1	Wf,	3260.7	8.0	Sg,	3265.8	8.1	Hj,	3266.8	8.1	Wf,
	3281.7	7.9	Pt,	3283.7	8.5	Ct,	3287.8	8.5	Ct.			
182224 SV HERCULIS—												
	3228.6	10.5	L,	3237.6	10.9	L,	3250.6	11.3	Wl,	3251.7	11.6	Pt,
	3262.6	12.5	L,	3281.7	13.8	Pt,	3281.7	13.4	B.			
182306 T SERPENTIS—												
	3228.6	<11.2	Pw,	3250.7	<13.0	Wl,	3281.7	12.8	Pt.			
183149 SV DRACONIS—												
	3206.4	11.7	Jp,	3206.4	11.6	Dp,	3232.4	9.0	Jp,	3232.4	9.2	Dp,
	3236.7	9.2	Wl.									
183225 RZ HERCULIS—												
	3249.8	<12.2	M,	3250.6	<13.5	Wl.						
183308 X OPHIUCHI—												
	2992.0	9.1	Nk,	3193.2	7.0	Ch,	3199.1	6.9	Nk,	3201.0	7.0	Nk,
	3220.0	7.6	Nk,	3221.0	7.5	Nk,	3226.0	7.3	Nk,	3230.5	7.5	L,
	3235.1	7.9	Nk,	3236.1	8.0	Nk,	3238.2	7.8	Ch,	3240.6	8.0	Cd,
	3251.7	8.0	Pt,	3255.6	8.2	Hj,	3256.4	8.2	L,	3257.7	8.7	Cd,
	3265.7	8.4	Hj,	3281.7	8.6	Pt,	3282.6	8.7	Cd.			
184134 RY LYRAE—												
	3228.6	12.3	O.	3235.6	<12.3	Wl,	3251.7	12.7	Pt,	3261.8	<11.7	M,
	3281.7	14.5	Pt.									

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
184205 R SCUTI—												
	3176.4	6.6	Ch,	3200.1	5.4	Kd,	3201.1	5.4	Nk,	3201.2	5.8	Ch,
	3202.1	5.6	Kd,	3203.4	5.7	Pe,	3204.1	5.4	Nk,	3207.1	5.6	Kd,
	3208.4	5.2	Pe,	3209.1	5.3	Nk,	3213.1	5.4	Nk,	3217.1	5.4	Nk,
	3218.7	5.3	Hj,	3220.0	5.2	Nk,	3220.7	5.3	Hj,	3220.7	4.4	Mu,
	3221.0	5.0	Kd,	3221.8	4.5	Mu,	3222.2	5.4	Ch,	3223.7	4.4	Mu,
	3224.7	4.4	Mu,	3225.7	4.5	Mu,	3225.8	5.5	Hj,	3226.1	5.2	Nk,
	3226.2	5.5	Kd,	3226.7	5.2	Pt,	3226.7	4.3	Mu,	3227.4	5.4	An,
	3227.4	5.2	L,	3227.5	5.1	Gi,	3227.8	5.4	Pt,	3227.8	4.5	Mu,
	3228.6	6.0	Su,	3228.7	5.3	Pt,	3228.8	4.5	Mu,	3228.8	5.3	Hj,
	3229.0	5.2	Nk,	3229.0	5.3	Kd,	3229.7	4.6	Mu,	3229.7	5.4	Pt,
	3229.8	5.5	Hj,	3230.0	5.4	Kd,	3230.7	4.5	Mu,	3231.4	5.4	Pe,
	3231.6	5.0	M,	3231.7	5.3	Pt,	3231.7	4.7	Mu,	3232.6	5.7	Su,
	3232.7	4.6	Mu,	3233.4	5.6	Pe,	3233.7	4.8	Mu,	3233.8	5.4	Pt,
	3234.4	5.7	Pe,	3234.6	5.4	L,	3234.7	4.7	Mu,	3235.1	5.2	Nk,
	3235.1	5.4	Kd,	3235.7	5.7	Pt,	3235.8	5.6	Hj,	3236.1	5.6	Nk,
	3236.2	5.4	Ch,	3236.8	5.5	Sg,	3237.6	5.1	L,	3239.5	5.4	Gi,
	3240.7	5.5	Hj,	3240.8	5.7	Pt,	3241.0	5.5	Kd,	3241.8	5.6	Pt,
	3243.7	5.5	Pt,	3244.7	5.4	Pt,	3246.8	5.2	Cd,	3247.0	5.7	Kd,
	3248.4	5.6	An,	3249.4	5.7	An,	3249.4	5.5	Gi,	3249.6	6.0	Pt,
	3249.6	6.0	Su,	3250.6	5.8	Pt,	3250.9	5.5	Sg,	3251.4	5.9	An,
	3251.6	5.5	Pe,	3251.6	5.1	M,	3251.7	5.8	Pt,	3252.0	5.5	Kd,
	3252.4	5.3	L,	3252.6	5.8	O,	3253.4	5.8	An,	3254.0	5.4	Kd,
	3254.4	5.9	An,	3254.6	5.8	Pt,	3254.7	5.7	Hj,	3255.0	5.5	Kd,
	3255.6	5.7	Su,	3255.6	5.8	Pt,	3255.7	5.8	Hj,	3256.0	5.5	Kd,
	3256.4	5.9	An,	3256.7	5.7	Pt,	3256.7	5.5	Jb,	3257.1	5.6	Kd,
	3257.4	5.5	L,	3257.7	5.7	Pt,	3258.4	5.5	Gi,	3258.7	5.8	Pt,
	3259.7	5.7	Hj,	3259.7	5.8	Pt,	3260.5	5.8	An,	3260.7	5.7	Pt,
	3261.6	5.8	O,	3261.7	5.3	Jb,	3261.7	5.9	Pt,	3262.4	5.9	An,
	3262.6	5.7	Cd,	3262.8	5.8	Sg,	3263.7	5.8	Pt,	3264.8	5 6	Pt,
	3265.4	5.8	An,	3265.6	5.8	O,	3265.6	5.9	Gd,	3265.7	5.5	Jb,
	3265.7	5.7	Hj,	3265.7	5.5	Su,	3267.6	5.3	Ro,	3267.6	5.6	Pt,
	3268.6	5.6	Pt,	3272.7	5.5	Sg,	3276.6	5.4	Pt,	3277.8	5.4	Pt.
	3278.6	5.5	Pt,	3279.7	5.6	Pt,	3279.7	5.4	Sg,	3280.6	5.8	O,
	3280.6	5.8	Su,	3280.7	5.6	Pt,	3280.8	5.3	M,	3281.6	5.4	Su,
	3281.7	5.5	Ct,	3281.7	5.5	Pt,	3282.7	5.5	Pt,	3283.6	5.4	Su,
	3284.6	5.9	Pt,	3285.6	5.9	Pt,	3285.6	5.9	Em,	3287.8	5.5	Ct,
	3288.6	6.0	Em,	3289.5	5.4	Cl.						
184208 S SCUTI—												
	3201.0	7.3	Nk,	3204.0	7.2	Nk,	3209.0	7.4	Nk,	3213.1	7.0	Nk,
	3226.0	7.2	Nk,	3235.1	7.3	Nk,	3236.0	7.3	Nk.			
184300 NOVA AQUILAE #3—												
	3178.4	9.9	Ch,	3196.2	10.0	Ch,	3208.5	10.0	Jp,	3208.5	9.9	Dp,
	3226.7	10.1	Pt,	3227.5	10.0	Gi,	3230.4	9.6	Pe,	3231.6	10.2	M,
	3231.6	10.0	Ro,	3232.4	10.0	L,	3233.4	10.0	Jp,	3233.4	10.0	Dp,
	3235.7	10.3	Pt,	3238.2	10.0	Ch,	3241.5	10.0	Gi,	3245.7	10.0	Sg,
	3248.8	9.6	To,	3249.6	10.3	Pt,	3256.4	10.0	L,	3257.7	10.5	Pt,
	3257.7	9.5	To,	3258.8	10.0	Sg,	3261.7	9.6	To,	3262.4	10.1	Gi,
	3265.7	9.6	To,	3267.6	10.3	Ro,	3276.6	10.5	Pt,	3278.6	10.5	Ro,
	3279.7	10.0	Sg,	3280.8	10.1	M,	3281.6	10.1	V,	3289.6	9.1	Cl.
185032 RX LYRAE—												
	3195.3	<11.9	Ch,	3229.1	11.1	Ch,	3229.8	12.0	M,	3238.2	12.0	Ch,
	3251.7	12.7	Pt,	3281.7	13.8	Pt.						
185243 R LYRAE—												
	3209.0	4.5	Nk,	3217.1	4.5	Nk,	3219.1	4.7	Nk,	3220.0	4.6	Nk,
	3226.1	4.8	Nk,	3229.0	4.4	Nk,	3230.0	4.8	Nk,	3235.1	4.2	Nk,
	3236.1	4.2	Nk.									
185512a ST SAGITTARII—												
	3196.3	<11.2	Ch,	3236.2	<12.2	Ch,	3252.4	<13.0	L.			

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
185634 Z LYRAE—												
	3221.8	<12.2	Br,	3227.8	13.0	Br,	3228.6	13.0	O,	3229.8	13.0	M,
	3232.4	14.3	L,	3257.4	12.9	L.						
185737 RT LYRAE—												
	3193.2	11.8	Ch,	3206.4	10.1	Jp,	3206.4	10.0	Dp,	3227.6	9.5	Pc,
	3227.8	10.0	Br,	3228.6	9.8	O,	3229.1	10.0	Ch,	3232.4	9.6	Jp,
	3232.4	9.8	Dp,	3235.6	10.2	Wl,	3257.1	10.9	Ch,	3261.8	11.5	M.
185905 V AQUILAE—												
	3201.1	7.8	Nk,	3204.0	7.9	Nk,	3213.1	6.9	Nk,	3236.1	7.4	Nk.
190108 R AQUILAE—												
	3193.2	11.0	Ch,	3231.7	6.3	M,	3238.2	6.8	Ch,	3251.7	6.8	Pt,
	3257.1	7.2	Ch,	3281.7	7.2	Pt.						
190529a V LYRAE—												
	3231.7	11.4	M,	3250.6	12.1	Pt.						
190818 RX SAGITTARII—												
	3235.8	<10.8	Br.									
190819a RW SAGITTARII—												
	3235.8	9.4	Br.									
190907b TY AQUILAE—												
	3231.8	10.7	Br,	3251.7	10.4	Pt,	3280.6	10.2	Pt.			
190925 S LYRAE—												
	3193.3	11.6	Ch,	3225.6	12.3	L,	3226.8	12.7	Lv,	3233.5	12.3	L,
	3234.8	12.4	Lv,	3250.6	12.2	Pt,	3261.4	13.1	L,	3261.8	<11.1	M.
	3280.6	13.5	Pt.									
190926 X LYRAE—												
	3250.6	9.0	Pt,	3261.8	8.5	M,	3280.6	8.8	Pt.			
190933a RS LYRAE—												
	3196.2	<11.8	Ch,	3226.8	14.1	Lv,	3227.8	14.0	Br,	3229.2	<11.8	Ch,
	3234.8	13.9	Lv,	3235.6	<12.6	Wl,	3257.1	<11.8	Ch.			
190941 RU LYRAE—												
	3206.4	<13.0	Jp,	3206.4	<13.0	Dp,	3228.6	13.8	Pc,	3232.4	<12.6	Jp,
	3232.4	<12.6	Dp,	3235.6	<12.6	Wl,	3276.7	14.	Pa.			
190967 U DRACONIS—												
	3177.6	12.8	Mi,	3195.2	<11.6	Ch,	3231.8	<12.1	Br,	3236.6	<13.0	Wl,
	3255.6	14.0	Pt,	3256.1	<11.6	Ch,	3280.6	13.2	Pt.			
191007 W AQUILAE—												
	3196.3	<11.0	Ch,	3228.7	13.3	Pc,	3231.8	<11.8	Br,	3257.2	<11.0	Ch,
191019 R SAGITTARII—												
	3201.3	7.6	Ch,	3220.7	7.1	Mu,	3228.7	7.0	Pc,	3229.3	7.0	Ch,
	3235.8	7.3	Br,	3239.2	7.0	Ch,	3247.7	8.0	Jb,	3251.6	7.7	Pc,
	3251.9	8.1	Sg,	3254.6	7.5	Pt,	3257.2	7.5	Ch,	3260.8	8.0	Sg,
	3280.6	8.7	Pt,	3280.7	9.5	Sg,	3281.7	<8.4	Ct,	3287.8	<9.9	Ct.
191033 RY SAGITTARII—												
	3204.4	<11.0	Ch,	3207.6	<12.0	L,	3208.5	<11.0	Jp,	3208.5	<11.0	Dp,
	3226.7	<10.0	Pt,	3227.8	<11.0	Pt,	3228.8	<11.0	Pt,	3229.3	11.5	Ch,
	3229.7	<11.0	Pt,	3230.5	11.4	L,	3231.7	8.9	M,	3233.5	11.5	L,
	3234.5	11.4	L,	3240.8	<10.0	Pt,	3249.6	<10.0	Pt,	3251.7	<11.0	Pt,
	3252.4	10.4	L,	3253.2	11.8	Ch,	3254.6	<11.0	Pt,	3255.6	<11.0	Pt,
	3256.7	11.5	Pt,	3257.7	<9.2	Pt,	3260.7	11.5	Pt,	3261.7	11.4	Pt,
	3262.8	10.5	To,	3263.7	11.4	Pt,	3265.8	10.	To,	3267.6	10.5	Pt.
	3276.6	<9.2	Pt,	3279.7	10.0	Pt,	3280.6	10.0	Pt,	3281.7	10.0	Pt,
	3285.7	10.0	Pt,	3288.6	9.2	Em.						
191319 S SAGITTARII—												
	3213.1	<12.7	Nk,	3227.6	14.4	Gi,	3231.7	<13.5	Pc,	3248.6	14.9	Pa,
	3251.9	<11.1	Sg,	3255.6	16.	Pa,	3256.4	<14.4	Gi,	3260.8	<11.1	Sg,
	3262.7	16.	Pa,	3280.7	<11.1	Sg,	3281.7	<8.4	Ct,	3283.7	16.	Pa,
	3287.8	<9.9	Ct.									
191321 Z SAGITTARII—												
	3227.6	<13.7	Gi,	3248.6	<15.0	Pa,	3255.6	16.	Pa,	3256.4	<13.7	Gi.
	3262.7	16.	Pa,	3283.7	16.	Pa.						

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
191350 TZ	CYGNI—											
	3206.4	10.2	Jp,	3206.4	10.2	Dp,	3229.8	10.7	To,	3233.4	10.6	Jp,
	3233.4	10.6	Dp,	3235.8	10.6	To,	3236.6	11.1	O,	3250.7	11.0	To,
	3255.6	10.1	Pt	3262.7	10.3	To,	3280.6	10.0	Pt.			
191637 U	LYRAE—											
	3240.8	10.6	M,	3255.6	10.9	Pt,	3261.8	11.8	M,	3280.6	10.8	Pt.
191920 TT	SAGITTARII—											
	3222.4	9.0	Au.									
192928 TY	CYGNI—											
	3176.4<	11.9	Ch,	3237.2<	11.9	Ch.						
193311 RT	AQUILAE—											
	3178.4<	12.4	Ch,	3227.7	13.0	Pc,	3231.7	12.6	M,	3231.8	12.0	Br,
	3237.2	11.5	Ch,	3255.6	10.2	Pt,	3280.6	9.8	Pt.			
193449 R	CYGNI—											
	3175.2	7.3	Ch,	3194.2	7.4	Ch,	3202.4	8.0	Pe,	3203.4	8.0	Pe,
	3206.4	7.0	Jp,	3206.4	7.2	Dp,	3206.4	8.1	Pe,	3217.7	8.4	Hj,
	3219.4	8.5	Pe,	3220.7	8.5	Hj,	3222.7	8.4	Hj,	3225.8	8.4	Hj,
	3226.7	8.4	Mu,	3228.2	8.2	Ch,	3228.8	6.6	Lv,	3228.8	8.5	Hj,
	3229.4	9.0	Pe,	3229.6	8.3	O,	3229.7	7.8	Pc,	3231.7	8.8	M,
	3231.8	8.0	Br,	3232.4	7.4	Jp,	3232.4	7.6	Dp,	3233.7	8.7	Hj,
	3234.8	8.0	Lv,	3235.4	8.8	Pe,	3237.2	8.2	Ch,	3237.7	8.7	Hj,
	3241.7	8.4	Hj,	3244.7	8.4	Hj,	3253.2	9.0	Ch,	3254.6	9.0	Pt,
	3254.8	8.9	Sg,	3255.6	8.7	Hj,	3257.6	9.0	O,	3261.6	8.9	Hj,
	3261.8	9.2	M,	3262.7	9.0	To,	3265.8	9.0	Hj,	3279.7	9.8	Sg,
	3280.6	9.7	Pt,	3280.6	9.9	Gd,	3280.6	10.3	M,	3281.7	9.8	V.
193509 RV	AQUILAE—											
	3232.8	12.0	Br,	3233.4	12.3	Jp,	3233.4	12.3	Dp,	3250.7<	12.2	To,
	3255.6	13.7	Pt,	3257.8<	12.2	To.						
194048 RT	CYGNI—											
	3175.3	11.5	Ch,	3194.3	11.9	Ch,	3209.7	10.3	Pc,	3211.4	9.8	Gi,
	3217.7	9.4	Hj,	3220.7	9.4	Hj,	3222.7	9.3	Hj,	3225.8	9.3	Hj,
	3227.4	9.1	Gi,	3228.3	9.0	Ch,	3228.8	9.2	Hj,	3229.7	9.0	Pc,
	3231.7	8.5	M,	3231.8	8.7	Br,	3233.7	9.0	Hj,	3237.2	8.4	Ch,
	3237.7	8.4	Hj,	3239.4	8.1	Gi,	3241.7	8.2	Hj,	3253.2	7.0	Ch,
	3254.4	7.3	Gi,	3254.6	7.0	Pt,	3254.8	7.5	Sg,	3255.6	7.7	Hj,
	3258.7	6.8	Jb,	3261.6	7.1	Hj,	3261.8	7.5	M,	3265.5	7.0	Gi,
	3265.8	7.0	Hj,	3279.7	7.4	Sg,	3280.6	7.0	Pt.			
194348 TU	CYGNI—											
	3194.3<	11.2	Ch,	3206.4	11.9	Jp,	3206.4	11.9	Dp,	3228.3	10.6	Ch,
	3228.8	8.3	Lv,	3229.7	10.5	Pc,	3231.7	10.0	M,	3231.9	10.0	Br,
	3232.4	10.2	Jp,	3232.4	10.2	Dp,	3237.2	10.2	Ch,	3237.7	10.0	Hj,
	3241.7	10.2	Hj,	3253.2	9.4	Ch,	3254.6	10.0	Pt,	3255.6	10.2	Hj,
	3261.8	10.0	M,	3280.6	10.1	Pt.	3281.7	10.1	V.			
194604 X	AQUILAE—											
	3220.8	13.4	Wf,	3226.6	13.5	Lv,	3227.7	13.2	Pc,	3230.8	13.3	Wf,
	3234.6	13.8	Lv,	3259.8	14.2	Wf,	3266.8	14.2	Wf.			
194632 χ	CYGNI—											
	3178.4<	11.9	Ch,	3195.4	11.2	Pe,	3203.4	11.6	Pe,	3206.4	11.5	Pe,
	3206.4	11.1	Jp,	3206.4	11.1	Dp,	3218.7<	10.2	Hj,	3219.4	10.9	Pe,
	3225.4	10.7	Pe,	3227.4	10.6	An,	3229.4	10.6	Pe,	3229.8	9.9	To,
	3230.4	10.4	Pe,	3231.4	10.4	Pe,	3231.9	9.6	Br,	3233.4	10.3	Pe,
	3233.4	9.7	Jp,	3233.4	9.6	Dp,	3233.7<	10.2	Hj,	3235.4	9.8	Pe,
	3236.4	9.7	Pe,	3236.3	10.2	Ch,	3236.6	10.3	Cl,	3237.7	9.7	Hj,
	3240.7	9.6	Hj,	3248.8	9.2	To,	3252.7	8.9	Lc,	3253.1	9.4	Ch,
	3254.7	9.3	Hj,	3255.6	8.5	Pt,	3257.7	10.4	Pt,	3257.7	8.2	To,
	3261.6	8.4	Hj,	3262.7	7.9	To,	3265.7	7.9	To,	3268.6	7.5	Pt,
	3280.6	6.8	Pt,	3281.6	7.1	V,	3283.7	6.6	Ct,	3284.8	8.2	M,
	3285.6	6.4	Em,	3287.8	6.7	Ct.						

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
195116 S SAGITTAE—												
	3220.7	5.5	Mu,	3221.8	5.9	Mu,	3223.7	5.4	Mu,	3224.7	5.3	Mu,
	3225.7	5.3	Mu,	3226.7	5.5	Mu,	3227.8	5.9	Mu,	3228.8	6.2	Mu,
	3229.7	6.3	Mu,	3230.7	6.0	Mu,	3231.7	5.6	Mu,	3232.7	5.5	Mu.
	3233.7	5.4	Mu,	3234.7	5.4	Mu.						
195302 RR AQUILAE—												
	3233.4	9.2	Jp,	3233.4	9.1	Dp,	3236.6	9.6	O,	3249.8	10.5	M,
	3250.7	10.5	Cd,	3250.8	9.6	To,	3255.6	10.5	Pt,	3257.8	10.0	To,
	3261.8	10.6	To,	3265.7	10.5	Cd,	3265.7	10.6	To,	3279.6	11.2	B,
	3280.7	10.8	Pt,	3280.8	11.2	M,	3281.6	10.6	Cd.			
195308 RS AQUILAE—												
	3221.9	<11.4	Br,	3232.9	<11.7	Br,	3233.4	12.1	Jp.	3233.4	12.0	Dp,
	3249.8	11.7	M,	3251.8	11.8	To,	3255.6	10.8	Pt,	3261.8	10.1	To,
	3265.8	9.9	To,	3280.7	9.1	Pt,	3280.8	9.0	M.			
195653 NOVA CYGNI *23*—												
	3178.4	9.9	Ch,	3208.5	10.5	Jp,	3208.5	10.8	Dp,	3226.7	10.0	Pt,
	3229.4	10.4	Gi,	3231.6	10.2	Ro,	3232.4	10.7	Jp,	3232.4	10.8	Dp,
	3232.4	10.4	L,	3235.7	10.0	Pt,	3236.1	10.0	Ch,	3241.8	10.3	Pt,
	3249.6	10.5	Pt,	3251.6	10.1	Cd,	3254.6	10.0	Pt,	3256.4	10.2	L,
	3257.7	9.9	Pt,	3259.4	10.3	Gi,	3260.7	10.2	Pt,	3263.6	10.4	Pt,
	3267.6	10.4	Pt,	3276.6	10.4	Pt,	3278.6	10.4	Pt,	3280.7	10.3	Pt,
	3281.6	10.0	V,	3283.7	10.2	Pt.						
195849 Z CYGNI—												
	3178.4	11.3	Ch,	3195.2	9.7	Ch,	3203.4	9.2	Pe,	3206.3	9.6	Ch,
	3208.5	8.6	Jp,	3208.5	8.7	Dp,	3215.4	8.7	Gi,	3220.8	8.9	Wf,
	3226.7	10.0	Mu,	3230.7	8.6	Wf,	3231.7	10.4	M,	3232.4	9.2	Jp,
	3232.4	9.3	Dp,	3233.4	9.1	Gi.	3236.1	9.6	Ch,	3244.4	9.4	Gi,
	3255.7	10.5	Pt,	3259.4	10.4	Gi,	3262.7	10.4	To,	3263.7	10.9	Wf,
	3273.8	11.8	Wf,	3280.7	13.1	Pt,	3280.8	12.0	M,	3281.7	<11.1	V,
200212 SY AQUILAE—												
	3207.6	11.6	L,	3221.9	<11.0	Br,	3230.5	12.0	L,	3232.9	<11.8	Br,
	3234.5	12.1	L,	3240.8	12.2	M,	3255.7	11.9	Pt,	3256.4	12.2	L,
	3259.7	<11.8	M,	3259.8	12.2	Wf,	3266.8	12.1	Wf,	3279.6	12.3	B,
	3280.7	13.2	Pt.									
200357 S CYGNI—												
	3221.9	<11.7	Br,	3227.6	14.1	Pc,	3227.9	14.3	Wf,	3228.8	<14.2	Lv,
	3232.9	<12.2	Br,	3259.8	<14.3	Wf,	3262.7	<14.1	Pa,	3262.7	<12.8	Fn,
	3266.8	<14.3	Wf,	3269.7	<14.3	Pa,	3283.7	<16.0	Pa.			
200514 R CAPRICORNI—												
	3207.6	9.9	Gi,	3233.5	10.4	Gi,	3235.9	<11.4	Br,	3241.8	12.0	Pt,
	3248.4	10.7	Gi,	3262.4	11.4	Gi,	3279.7	12.3	B,	3280.7	12.0	Pt.
200647 SV CYGNI—												
	3226.7	8.9	Mu.									
200715a S AQUILAE—												
	3220 8	10.2	Wf,	3222.6	9.7	Gi,	3226.7	10.6	Mu,	3230.7	10.0	Wf,
	3231.7	10.8	M,	3231.9	10.4	Br,	3234.5	10.3	Gi,	3236.6	10.1	O,
	3242.0	10.1	Kd,	3246.4	9.8	Gi.	3252.7	10.7	Lc.	3255.7	10.0	Pt.
	3257.0	10.1	Kd,	3258.5	9.7	Gi,	3259.8	10.0	Wf,	3263.4	10.6	Bp.
	3263.4	10.4	Ma,	3263.4	10.6	Au,	3266.8	11.2	Wf,	3280.6	10.6	M,
	3280.7	10.9	Pt.									
200715b RW AQUILAE—												
	3226.7	9.0	Mu,	3231.7	9.2	M.	3236.6	9.5	O.	3252.7	9.6	Lc.
	3280.6	8.5	M,	3280.7	9.6	Pt.						
200747 RX CYGNI—												
	3226.7	7.9	Mu.									
200812 RU AQUILAE—												
	3231.9	10.4	Br.									
200822 W CAPRICORNI—												
	3255.7	11.0	Pt,	3280.7	12.0	Pt.						
200906 Z AQUILAE—												
	3231.5	13.7	Gi,	3231.9	<11.2	Br,	3240.8	11.0	M,	3254.4	13.7	Gi,
	3255.7	13.5	Pt,	3265.5	12.9	Gi,	3280.6	13.0	M.	3280.7	10.5	Pt.

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
200916 R SAGITTAE—												
	3231.7	9.1	M,	3252.7	9.1	Lc,	3280.6	8.6	M.			
200938 RS CYGNI—												
	3176.4	8.8	Ch,	3201.2	8.9	Ch,	3203.4	8.6	Pe,	3226.7	8.8	Mu,
	3228.2	8.9	Ch,	3230.4	8.0	L,	3231.6	9.0	M,	3237.1	8.3	Ch,
	3252.4	7.9	L,	3254.7	8.8	Sg,	3255.7	8.4	Pt,	3263.4	8.9	Ma,
	3263.4	9.0	Bp,	3263.4	9.0	Au,	3278.7	8.8	Sg,	3280.7	8.0	Pt,
	3284.8	9.0	M.									
201008 R DELPHINI—												
	3207.6	9.0	L,	3230.5	7.7	L,	3230.7	8.1	O,	3233.8	7.8	Br,
	3255.7	8.2	Pt,	3256.4	8.1	L,	3265.8	8.7	M,	3280.7	9.4	Pt.
201121 RT CAPRICORNI—												
	3229.2	7.5	Kd,	3234.5	6.5	L,	3235.1	7.3	Kd.	3252.7	7.5	Lc,
	3254.0	7.2	Kd,	3256.1	7.2	Kd,	3262.5	6.3	L,	3280.7	6.5	Pt.
201130 SX CYGNI—												
	3231.9<12.0		Br,	3236.6	11.7	O.						
201437b WX CYGNI—												
	3226.7	10.3	Mu,	3231.7	10.2	M,	3232.9	9.3	Br.	3252.7	10.7	Wl.
	3254.7	10.5	Sg,	3255.7	10.8	Pt,	3259.8	9.8	Wf,	3266.8	10.4	Wf,
	3279.6	10.3	B,	3279.7	10.0	Sg,	3280.7	10.4	Pt,	3284.8	10.6	M.
201647 U CYGNI—												
	3203.4	8.8	Pe,	3211.4	7.8	Gi,	3226.7	7.8	Mu,	3229.4	9.0	Pe,
	3231.6	7.8	Ro,	3233.7	7.7	Hj,	3234.4	7.9	Gi,	3240.7	7.6	Hj,
	3246.4	8.0	Gi,	3246.7	7.9	Jb,	3248.7	7.8	Jb,	3252.6	9.0	M,
	3252.7	8.0	Lc,	3255.6	8.4	Hj,	3255.7	7.9	Jb,	3255.7	8.0	Pt,
	3261.4	8.2	Bp,	3261.4	7.9	Au,	3265.7	8.0	Jb,	3267.6	8.4	Ro,
	3280.6	9.0	M,	3280.7	8.4	Pt.						
202539 RW CYGNI—												
	3252.6	9.0	M,	3265.8	8.5	M,	3280.6	9.2	M.			
202622 RU CAPRICORNI—												
	3222.6	9.7	Gi,	3233.6	9.6	Gi,	3248.4	9.1	Gi,	3261.4	9.2	Gi.
202817 Z DELPHINI—												
	3231.9	11.5	Br,	3255.7	13.1	Pt.						
202946 SZ CYGNI—												
	3226.7	8.8	Pt,	3229.7	9.5	Pt,	3235.7	10.0	Pt,	3250.6	9.6	Pt,
	3252.6	10.0	M,	3257.7	9.4	Pt,	3261.7	9.6	Pt,	3280.7	9.6	Pt,
	3284.8	9.2	M.									
202954 ST CYGNI—												
	3221.9<12.1		Br,	3229.6	12.8	Wl,	3232.9<12.6		Br,	3259.8	13.1	Wf,
	3266.6	12.5	M,	3266.8	13.2	Wf.						
203226 V VULPECULAE—												
	3252.6	9.0	M,	3255.7	8.8	Pt,	3280.7	8.7	Pt,	3284.8	8.7	M.
203611 Y DELPHINI—												
	3229.8<12.4		M,	3231.9<11.7		Br.						
203816 S DELPHINI—												
	3231.9	11.2	Br,	3236.6	10.4	Cl,	3261.8	11.2	M.			
203847 V CYGNI—												
	3176.4	11.7	Ch,	3211.4	9.9	Gi,	3221.9	10.0	Br,	3226.6	11.3	Pc,
	3229.7	11.7	Wl,	3234.4	9.5	Gi,	3235.8	10.1	Br,	3237.2	11.4	Ch,
	3246.4	9.5	Gi,	3252.6	10.8	M,	3285.6	7.6	Pt.			
203905 Y AQUARII—												
	3234.9	10.1	Br,	3255.7	9.4	Pt,	3265.8	9.5	M.	3280.7	9.2	Pt.
204016 T DELPHINI—												
	3220.8	14.5	Wf,	3221.8<10.9		Sg,	3227.8	14.5	Wf,	3227.8<14.3		Br,
	3228.8<12.2		Sg,	3255.6	14.4	Pa,	3259.8	14.5	Wf,	3262.7	14.2	Pa,
	3266.9	14.5	Wf,	3269.7	14.2	Pa,	3276.7	13.8	Pa,	3283.7	13.7	Pa.
204102 V AQUARII—												
	3231.9	8.8	Br,	3285.6	8.0	Pt.						
204104 W AQUARII—												
	3228.6	10.8	Gi,	3233.5	11.7	L,	3234.9	11.3	Br.	3240.4	11.3	Gi,
	3257.4	11.7	Gi,	3262.5	11.8	L.	3265.8	11.6	M.			

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
204215 U CAPRICORNI—												
	3222.6	<13.6	Gi,	3233.6	<13.8	Gi,	3235.9	<10.7	Br,	3255.5	13.2	Gi,
	3262.7	12.5	Fn,	3265.4	12.6	Gi,	3285.7	11.2	Pt.			
204318 V DELPHINI—												
	3206.6	15.5	Pa,	3231.5	<14.7	Gi,	3231.9	<12.1	Br,	3234.6	15.1	Pa,
	3255.6	<15.6	Pa,	3256.4	<14.7	Gi,	3262.7	<15.6	Pa,	3283.7	<16.0	Pa.
204405 T AQUARII—												
	3176.4	8.0	Ch,	3199.4	8.8	Ch,	3233.9	11.3	Br,	3236.2	11.5	Ch,
	3255.7	12.7	Pt.	3265.8	<11.6	M,	3280.7	13.2	Pt.			
204846 RZ CYGNI—												
	3221.9	<11.9	Br,	3227.4	11.5	Gi,	3233.8	<11.1	Br,	3252.7	13.0	Wl,
	3254.4	12.7	Gi,	3255.7	13.1	Pt,	3259.9	12.8	Wf,	3262.7	<13.2	Fn,
	3265.6	12.7	Gi,	3266.9	13.4	Wf,	3269.7	12.9	Pa,	3280.7	13.6	Pt,
	3283.7	12.9	Pa.									
205017 X DELPHINI—												
	3229.7	10.2	M,	3231.9	10.3	Br,	3235.8	10.0	Br,	3242.6	9.0	O,
	3265.8	9.2	M.									
205923 R VULPECULAE—												
	3207.6	9.6	Gi,	3220.5	10.7	Gi,	3229.8	11.3	Hj,	3231.9	<11.4	Br,
	3234.5	11.6	Gi,	3235.8	<11.4	Hj,	3240.7	<11.4	Hj,	3252.6	<11.0	M,
	3254.4	13.1	Gi,	3255.7	<11.4	Hj,	3259.9	13.5	Wf,	3265.6	13.0	Gi,
	3265.7	<11.8	Hj,	3266.9	13.5	Wf,	3280.7	11.0	Pt.			
210116 RS CAPRICORNI—												
	2993.0	8.1	Nk,	2999.0	8.0	Nk.						
210124 V CAPRICORNI—												
	3222.6	<12.7	Gi,	3233.6	13.0	Gi,	3255.5	11.5	Gi,	3265.4	9.8	Gi.
210129 TW CYGNI—												
	3231.9	<12.0	Br,	3262.7	14.3	Pa,	3269.7	14.3	Pa,	3276.7	14.0	Pa.
210221 X CAPRICORNI—												
	3222.6	<12.7	Gi,	3233.6	<12.7	Gi,	3255.5	11.2	Gi,	3265.5	10.6	Gi.
210382 X CEPHEI—												
	3221.9	<11.4	Br,	3224.7	<11.4	Sg,	3233.8	<11.4	Br,	3255.6	<16.0	Pa,
	3262.7	<15.0	Pa,	3283.7	<16.0	Pa.						
210504 RS AQUARII—												
	3233.5	10.0	L,	3234.9	10.6	Br,	3249.8	9.7	M,	3262.5	9.8	L,
	3285.7	10.9	Pt.									
210516 Z CAPRICORNI—												
	3235.9	<10.2	Br,	3285.7	10.7	Pt.						
210812 R EQUULEI—												
	3231.7	13.2	M,	3231.9	<11.9	Br.						
210868 T CEPHEI—												
	3176.4	6.4	Ch,	3204.4	6.5	Ch,	3220.7	6.9	Mu,	3221.8	6.9	Mu,
	3223.7	7.0	Mu,	3224.7	7.0	Mu,	3225.7	7.0	Mu,	3226.7	7.0	Mu,
	3227.8	7.1	Mu,	3228.8	7.1	Mu,	3229.7	7.1	Mu,	3229.7	6.5	Pt,
	3230.5	6.5	L,	3230.7	7.1	Mu,	3231.7	7.2	Mu,	3232.7	7.1	Mu,
	3233.7	7.2	Mu,	3234.7	7.3	Mu,	3237.2	6.7	Ch,	3243.6	8.0	O,
	3249.8	8.2	M,	3252.6	6.8	Cg,	3255.4	7.5	L,	3257.6	8.5	O,
	3261.4	7.8	Bp,	3261.4	8.0	Au,	3261.7	8.0	Sg,	3261.7	7.6	Pt,
	3264.6	8.1	Cg,	3265.6	8.4	O,	3265.6	8.7	Gd,	3265.6	8.7	Ya,
	3280.8	8.5	Sg,	3281.6	9.0	Cg.						
210903 RR AQUARII—												
	3234.9	<11.4	Br,	3249.8	11.5	M,	3285.7	9.7	Pt.			
211614 X PEGASI—												
	3207.6	11.1	Gi,	3227.6	12.2	Gi,	3229.7	12.5	Pt,	3234.9	<11.7	Br,
	3239.5	12.5	Gi,	3255.4	13.0	Gi,	3261.7	14.2	Pt.	3266.4	13.0	Gi.
211615 T CAPRICORNI—												
	3235.9	<10.5	Br,	3285.7	13.6	Pt.						
212814 Y CAPRICORNI—												
	3251.8	<11.2	M,	3285.7	13.4	Pt.						

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.
213244 W CYGNI—								
	3201.2	6.4 Kd,	3205.1	6.6 Kd,	3207.1	6.1 Kd,	3217.1	6.1 Kd,
	3222.4	6.0 L,	3226.2	6.5 Kd,	3227.4	5.8 An,	3229.0	6.3 Nk,
	3229.0	6.2 Kd,	3230.0	6.3 Nk,	3230.1	6.1 Kd,	3235.1	6.2 Kd,
	3235.4	5.6 L,	3236.2	6.7 Nk,	3242.1	6.3 Kd,	3249.4	6.6 An.
	3252.0	6.2 Kd,	3254.0	6.4 Kd,	3255.0	6.4 Kd,	3256.0	6.4 Kd,
	3256.4	5.7 L,	3257.1	6.5 Kd,	3260.5	6.6 An.		
213678 S CEPHEI—								
	3215.4	8.3 Gi,	3229.7	8.0 Pt,	3234.8	8.8 Br,	3239.5	8.3 Gi.
	3245.7	8.7 M,	3261.7	8.0 Pt,	3284.8	8.6 M.		
213753 RU CYGNI—								
	3229.7	8.0 Pt,	3245.7	8.2 M,	3259.7	9.0 M,	3261.7	8.0 Pt.
213843 SS CYGNI—								
	3176.4	8.3 Ch,	3201.1	<11.9 Nk,	3201.4	11.6 Jp,	3201.4	11.7 Dp,
	3204.4	11.9 Jp,	3204.4	11.8 Dp,	3205.4	11.7 Jp,	3205.4	11.6 Dp,
	3206.4	11.9 Jp,	3206.4	11.9 Dp,	3207.4	11.9 Jp,	3207.4	12.0 Dp,
	3207.4	11.9 Gi,	3207.6	11.6 L,	3208.5	12.0 Jp,	3208.5	11.9 Dp,
	3209.4	11.9 Gi,	3211.4	11.9 Gi,	3212.4	12.0 Jp,	3212.4	12.0 Dp,
	3213.1	12.1 Nk,	3215.4	12.0 Gi,	3216.4	12.0 Gi,	3217.1	11.8 Nk,
	3217.4	12.0 Jp,	3217.4	12.0 Dp,	3217.7	<11.3 Hj,	3218.7	<10.9 Hj.
	3219.4	12.0 Gi,	3219.4	11.9 Pe,	3219.9	12.0 Wf,	3220.1	<11.8 Nk,
	3220.4	12.0 Jp,	3220.4	12.0 Dp,	3220.5	11.9 Gi,	3220.7	<11.3 Hj,
	3220.8	12.0 Wf,	3221.4	11.9 Gi,	3221.8	12.0 Br,	3222.4	12.1 L,
	3222.6	11.9 Gi,	3222.7	<11.3 Hj,	3223.8	12.0 Wf,	3224.8	12.0 Wf,
	3225.4	11.9 Pe,	3225.8	<11.3 Hj,	3226.1	<11.8 Nk,	3226.6	12.0 Pc,
	3226.7	12.0 Wf,	3226.7	<10.9 Mu,	3226.7	11.9 Pt,	3227.4	11.8 An,
	3227.4	11.9 Gi,	3227.4	11.9 L,	3227.6	12.0 Pc,	3227.7	11.8 Wf,
	3227.8	12.0 M,	3227.8	11.9 Br,	3227.8	11.8 Pt,	3228.2	11.6 Ch,
	3228.4	11.3 Gi,	3228.5	11.3 L,	3228.6	11.3 Pc,	3228.6	11.3 Pt.
	3228.6	11.2 Gi,	3228.6	10.6 O.	3228.7	10.8 Pt,	3228.7	11.3 Pc,
	3228.8	10.7 Pt,	3228.8	10.9 Hj,	3228.8	10.6 M,	3229.1	9.8 Nk,
	3229.3	8.5 Ch,	3229.4	9.1 Gi,	3229.4	9.3 Pe,	3229.6	8.2 Wl,
	3229.6	8.3 O,	3229.6	8.3 Pc,	3229.7	8.7 Pt.	3229.8	8.3 Hj,
	3229.8	8.7 To,	3229.8	8.4 M,	3229.8	8.4 Wf,	3230.0	8.4 Nk,
	3230.1	8.3 Nk,	3230.2	8.2 Nk,	3230.4	8.6 L,	3230.4	8.6 Pe,
	3230.7	8.4 Wf,	3230.7	8.3 O,	3230.8	8.2 M,	3231.4	8.8 Pe,
	3231.5	8.5 Gi,	3231.6	8.3 O,	3231.6	8.3 Pc,	3231.6	8.1 Ro,
	3231.7	8.5 Br,	3231.8	8.4 To,	3231.8	8.2 M,	3231.9	8.5 Br,
	3232.4	8.3 Jp,	3232.4	8.4 Dp,	3232.4	8.4 Gi,	3232.4	8.4 L,
	3232.8	8.4 Wf,	3232.8	8.6 Br,	3232.8	8.5 Br,	3232.9	8.5 Br,
	3233.4	8.6 Jp,	3233.4	8.7 Dp,	3233.4	8.3 Gi,	3233.4	8.6 L,
	3233.4	8.4 Pe,	3233.7	8.1 Hj.	3233.7	8.5 Br,	3234.3	8.4 Jp,
	3234.3	8.5 Dp,	3234.4	8.4 Gi,	3234.5	8.4 L,	3234.7	8.6 Br.
	3234.8	8.6 Br,	3234.8	8.3 To,	3234.9	8.6 Br,	3235.1	8.1 Nk,
	3235.4	8.3 Pe,	3235.4	8.6 L.	3235.4	8.4 Gi,	3235.7	8.6 Br,
	3235.7	8.7 Pt,	3235.8	8.3 M,	3235.8	8.6 Br,	3235.8	8.6 Wf,
	3235.8	8.3 Hj,	3235.9	8.6 Br,	3236.0	8.0 Nk,	3236.2	8.3 Ch,
	3236.4	8.4 Pe,	3236.6	8.4 Cd,	3236.6	8.3 O,	3236.6	8.2 Cl,
	3236.7	8.6 Br,	3236.8	8.3 M,	3237.4	8.6 Pe,	3237.6	8.5 L.
	3237.7	8.5 Br,	3237.7	8.4 Hj,	3237.8	8.4 M.	3237.8	8.5 Wf,
	3238.2	8.3 Ch,	3238.6	8.4 Cd,	3238.7	8.6 Br,	3238.9	8.7 Wf,
	3239.2	8.4 Ch,	3239.4	8.7 Gi,	3239.7	8.6 Br,	3239.7	8.8 Wf,
	3240.4	8.5 Ch,	3240.4	8.7 Gi,	3240.7	9.0 Hj,	3240.8	8.9 Wf,
	3240.8	8.7 Pt,	3240.8	8.8 M,	3241.4	8.8 Gi,	3241.7	9.1 Hj,
	3241.8	8.8 Pt,	3241.8	8.9 M,	3242.0	8.3 Kd,	3242.4	9.1 Gi,
	3242.6	8.8 O,	3242.7	9.3 Hj,	3242.8	9.2 M,	3243.6	9.6 O,
	3243.7	9.5 Pt,	3244.4	9.9 Gi,	3244.7	9.9 Pt,	3244.7	10.2 Hj,
	3244.8	10.2 M,	3245.2	9.9 Ch,	3245.8	10.2 To,	3245.8	10.3 M,
	3246.4	10.8 Gi.	3246.8	10.5 M,	3247.5	11.1 Gi,	3247.7	10.6 To,
	3247.8	11.5 Sg,	3247.8	10.7 M,	3248.4	11.4 Gi.	3249.4	11.5 Gi.

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.	J.D.	Est.Obs.
213843 SS CYGNI—Continued.								
	3249.6	11.8 Pt,	3249.8	11.5 M,	3250.6	11.4 Cd,	3250.6	11.8 Pt,
	3251.6	11.7 Pc,	3251.7	11.7 Pt,	3251.8	11.2 To,	3251.8	11.3 M,
	3252.4	11.6 L,	3252.6	11.4 Cd,	3252.6	<9.6 O,	3252.6	11.5 M,
	3253.2	11.8 Ch,	3254.4	11.8 Gi,	3254.6	11.7 Pt,	3254.7	11.1 Hj,
	3255.4	11.8 Gi,	3255.6	11.8 Pt,	3255.7	11.3 Hj,	3256.4	11.7 Gi,
	3256.4	11.4 L,	3256.7	11.8 Pt,	3257.1	11.6 Kd,	3257.4	11.9 L,
	3257.4	11.8 Gi,	3257.6	<9.6 O,	3257.7	11.8 Pt,	3257.8	11.8 To,
	3258.5	11.8 Gi,	3258.7	12.0 Wf,	3259.4	11.8 Gi,	3259.6	12.0 M,
	3259.7	<10.9 Hj,	3259.9	11.9 Wf,	3260.7	11.7 Pt,	3260.7	<10.9 Sg,
	3260.8	12.1 Wf,	3261.5	11.9 Gi,	3261.6	<10.9 Hj,	3261.6	<9.6 O,
	3261.7	11.8 Pt,	3262.4	12.0 Gi,	3262.5	12.0 L,	3262.7	12.0 To,
	3262.9	12.0 Wf,	3263.4	12.0 Gi,	3263.6	11.9 Pt,	3263.7	12.0 Wf,
	3264.8	11.6 Pt,	3264.9	11.9 Wf,	3265.4	12.0 Gi,	3265.6	<9.6 Gd,
	3265.6	<9.6 Ya,	3265.6	<9.6 O,	3265.7	11.8 Hj,	3265.8	12.0 To,
	3265.8	11.9 Wf,	3266.4	12.0 Gi,	3266.9	11.9 Wf,	3267.4	12.0 Gi,
	3267.6	11.9 Pt,	3268.6	11.8 Pt,	3273.8	11.9 Wf,	3274.7	<10.9 Wf,
	3276.6	12.1 Ya,	3276.6	11.9 Pt,	3277.8	11.6 Pt,	3278.6	11.4 Ro,
	3278.6	11.8 Pt,	3279.6	10.2 B,	3279.7	11.0 Pt,	3279.8	11.5 Sg,
	3280.6	11.9 Gd,	3280.6	<10.0 O,	3280.7	11.8 Pt,	3281.6	12.0 Em,
	3281.6	<11.8 Ya,	3281.7	<11.3 V,	3281.7	11.8 Pt,	3282.6	<10.9 Ya,
	3282.7	11.7 Pt,	3283.7	11.7 Pt,	3284.8	11.5 Pt,	3285.6	11.5 Em,
	3285.7	11.6 Pt,	3286.8	12.2 M,	3288.5	12.0 Em,	3289.5	11.9 Cl,
213937 RV CYGNI—								
	3231.6	8.0 M,	3250.6	6.6 Pt,	3252.6	7.8 M,	3261.7	6.6 Pt,
	3265.8	7.8 M.						
214024 RR PEGASI—								
	3234.8	<12.0 Br,	3269.7	14.0 Pa,	3276.7	<13.4 Pa,	3281.6	14.0 Pt.
215605 Y PEGASI—								
	3234.9	<11.5 Br,	3262.7	14.2 Pa,	3269.7	14.0 Pa,	3276.7	13.6 Pa,
	3283.7	13.5 Pa,	3285.7	12.8 Pt.				
215717 U AQUARII—								
	3235.9	<11.5 Br,	3241.7	12.0 Pt.	3281.7	11.6 Pt.		
215934 RT PEGASI—								
	3234.8	10.7 Br,	3264.8	<11.7 Sg,	3281.7	10.8 Pt.		
220133a RY PEGASI—								
	3285.7	12.2 Pt.						
220133b RZ PEGASI—								
	3234.9	<12.2 Br,	3285.7	10.0 Pt.				
220412 T PEGASI—								
	3207.6	9.5 L,	3227.6	9.7 Gi,	3234.5	10.1 L,	3234.9	10.2 Br,
	3239.5	10.2 Gi,	3240.8	10.2 M,	3246.8	10.3 M,	3255.4	10.7 Gi,
	3256.4	11.0 L,	3262.8	11.0 M,	3266.4	11.5 Gi.		
220613 Y PEGASI—								
	3227.6	12.7 Gi,	3234.9	<12.0 Br,	3239.5	13.6 Gi,	3255.5	14.8 Gi.
220714 RS PEGASI—								
	3227.6	12.7 Gi,	3234.9	<12.0 Br,	3239.6	12.0 Gi,	3255.5	11.0 Gi,
	3266.4	10.3 Gi.						
221321 X AQUARII—								
	3249.8	10.5 M.						
221722 RT AQUARII—								
	3249.8	11.4 M.						
222439 S LACERTAE—								
	3220.5	9.1 Gi,	3231.7	9.8 M,	3233.5	9.6 Gi,	3233.5	9.8 L,
	3244.5	10.0 Gi,	3257.4	10.9 Gi,	3262.5	11.6 L,	3267.4	11.4 Gi,
	3281.6	12.7 Pt.						
223841 R LACERTAE—								
	3207.6	9.1 L,	3220.6	8.8 Gi,	3231.7	8.9 M,	3233.4	8.8 Gi,
	3233.5	8.8 L,	3244.5	9.0 Gi,	3257.4	9.4 Gi,	3262.5	9.6 L,
	3267.4	9.9 Gi.						

VARIABLE STAR OBSERVATIONS, June 20 to August 20, 1922—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.	J.D.	Est.	Obs.
225120 S AQUARII—												
	3249.8	<11.7	M.									
225914 RW PEGASI—												
	3232.9	<11.2	Br,	3236.8	11.5	M,	3261.8	<9.9	Sg,	3279.8	<11.2	Sg.
230110 R PEGASI—												
	3204.4	10.0	Ch,	3228.8	11.3	Pt,	3232.9	11.0	Br,	3242.8	10.5	M,
	3251.8	<10.1	Sg,	3262.8	10.0	To,	3264.8	<10.1	Sg,	3265.7	<10.9	Hj,
	3281.6	12.5	Pt.									
230759 V CASSIOPEIAE—												
	3227.5	12.0	Gi,	3228.8	12.0	Pt,	3233.4	<12.2	Pe,	3240.4	11.1	Gi,
	3255.6	10.6	Gi,	3260.4	10.5	Bp,	3260.4	11.0	Au,	3266.4	10.0	Gi,
	3281.6	9.5	Pt.									
231425 W PEGASI—												
	3207.6	11.0	L,	3234.5	12.2	L,	3235.8	<11.8	M,	3256.4	12.5	L.
231508 S PEGASI—												
	3228.8	8.6	Pt,	3281.6	9.0	Pt.						
233335 ST ANDROMEDAE—												
	3178.4	9.8	Ch,	3220.8	10.6	Wf,	3227.8	10.7	M,	3228.8	10.2	Pt,
	3230.8	10.7	Wf,	3234.9	10.5	Br,	3259.9	10.8	Wf,	3266.9	10.9	Wf.
	3281.6	11.0	Pt.									
233815 R AQUARII—												
	3199.4	9.1	Ch,	3228.8	9.1	Pt,	3257.7	9.5	Cd,	3269.7	10.3	Pa.
	3276.7	9.6	Pa,	3281.7	10.0	Pt.						
233956 Z CASSIOPEIAE—												
	3220.8	<13.4	Wf,	3230.8	<14.0	Wf,	3259.9	<14.0	Wf,	3266.9	<14.0	Wf.
235053 RR CASSIOPEIAE—												
	3227.4	13.8	Gi,	3254.5	14.3	Gi,	3266.4	14.5	Gi.			
235209 V CETI—												
	3228.8	12.5	Pt,	3234.6	<13.2	L,	3239.6	13.5	Gi,	3256.5	14.3	Gi,
	3262.6	<13.6	L,	3267.6	<14.4	Gi,	3269.7	14.3	Pa.			
235350 R CASSIOPEIAE—												
	3227.5	12.0	Gi,	3256.5	11.8	Gi.						
235525 Z PEGASI—												
	3228.8	11.4	Pt,	3281.7	12.8	Pt.						
235715 W CETI—												
	3239.6	11.4	Gi,	3256.5	12.2	Gi,	3267.6	13.2	Gi.			
235855 Y CASSIOPEIAE—												
	3227.5	12.3	Gi,	3255.4	13.1	Gi,	3269.7	12.8	Pa,	3276.7	12.9	Pa,
	3283.7	13.0	Pa.									
235939 SV ANDROMEDAE—												
	3228.8	11.3	Pt,	3262.8	8.6	M,	3281.7	8.4	Pt.			

	Observations	Stars	Observers
June-July	1739		30
July-Aug.	1354		32
Totals	3093	305	43

has been seriously ill with appendicitis, is on the road to recovery and eager for further achievements.

Attention is called to the Annual Meeting of the Association, which is to be held at Harvard College Observatory on Saturday, November 4; to the initiated such an announcement spells the promise of a very pleasant gathering.

The Post 6-inch telescope has been erected in the west dome of the Harvard Observatory, and is available for the use of members upon application to the Telescope Committee. The instrument has been completely renovated, and presents a fitting memorial to the late Charles Alfred Post.

The following observers contributed to this report: Messrs. Ancarani "An," Aurino "Au," Bemporad "Bp," Bouton "B," Brocchi "Br," Chandler "Cd," Chandra "Ch," Christie "Ct," Clement "Cl," Clough "Cg," Elmer "Em," Farnsworth "Fn," Ginori "Gi," Godfrey "Gd," Hoerl "Hj," Jacobsen "Jb," Kanda "Kd," Lacchini "L," Lacy "Lc," Leavenworth "Lv," Macaughey "Mc," McAteer "M," Merola "Ma," Miss Miller "Mi," Mundt "Mu," Nakamura "Nk," Olcott "O," Dr. Paraskevopoulos "Jp," Mrs. Paraskevopoulos "Dp," Parkhurst "Pa," Peltier "Pt," de Perrot "Pe," Proctor "Pc," Rabinowitz "Ra," Rhorer "Ro," Skaggs "Sg," Suter "Su," Townley "To," Vrooman "V," Waldo "Wl," Waterfield "Wf," Watson "Pw," and Yalden "Ya."

HOWARD O. EATON, Recording Secretary.

COMMUNICATIONS.

Occultations. — In the August and September Number of POPULAR ASTRONOMY, I am much interested in Prof. Rigge's article on the occultation of Alpha Tauri (Aldebaran) by the moon. As an amateur I have always watched such phenomena with great delight, especially since 1918, when I first got my 4-inch equatorial. I remember a specially beautiful occurrence of the kind that I observed in 1920. My note book has the following entry:

"Washta, Iowa, Nov. 15, 1920, time 7^h 25^m.—Observed moon occult 54 Sagittarii, a beautiful little double, colors yellow and blue, yellow star was eclipsed first, about a minute after moon passed over little blue star, a pretty sight. Seeing good, moon five days old."

54 Sagittarii was not listed in the Ephemeris for occultation on that date; but I found the position of the moon for that time to be R. A. 19^h 34^m, Dec. $-16°$ 29′, which would be about the place where 54 Sagittarii is charted on the maps. I found in "The Pleasures of the Telescope" Mr. Serviss lists that star as a double; magnitudes 6 and 7.5; distance 45″; colors yellow and blue. Last night I picked up the little double, to renew acquaintance. Almost in the same field is another little double, both yellow, about magnitude 6.5, distance 15″, this double is not on my maps. I was called away and did not get to see the emersion of 54 Sagittarii. Whenever I go into my observatory and the moon is above the horizon, I set the telescope on it and clamp the declination axis, then by turning the slow motion so as to cause the objective to sweep eastward two or three times the moon's diameter, I can pick up any star that is located in the path of the moon.

Will POPULAR ASTRONOMY please tell the amateurs, why the light from a star, such as Aldebaran would not be deflected a little while passing close to the moon or one of the larger planets in a similar manner to that which Prof. Einstein claims happens when passing close to the sun.

FRED S. CARRINGTON.

On Silvering Mirrors.—We have just read in Vol. XXX, No. 2, of your esteemed paper, on page 93, that mirror-silvering by the formic aldehyde process has been studied in 1912 by Mr. Everett King. Now, that process has been studied by Messrs. Lumière as far back as 1894 and it is described by them in the "Journal de Physique Théorique et Appliquée," on page 29.

Later on, in 1904, Messrs. Lumière brought a slight change into their process, and the new formulae are being regularly published in the Agenda Lumière,

ever since 1904. We may add that, at the Lyons Astronomical Observatory, the mirrors for the elbow-equatorial and for the siderostat are being regularly silvered by the Lumière process.

LUMIÈRE & JOUGLA.

Lyons, 21 Rue St. Victor, Sept. 9, 1922.

Occultation of Aldebaran, Sept. 13.—It was with much pleasure that I observed the occultation of Aldebaran this week. I had the good fortune to have with me at the time, Mr. and Mrs. George Hale Hamilton, the former a Martian astronomer of note and the latter a skilled computer, who reduced the figures in the Ephemeris for Prescott's latitude and longitude and obtained a satisfactory approximation with the only fairly accurate figures for the city's place.

We used a 4-inch glass and in the extremely clear and steady atmosphere of Prescott—a mile above the sea—obtained a fine view of the spectacle. The phenomenon occurred at $3^h\ 35^m\ 54^s$, Prescott local time, which checked sufficiently closely with the maps given in Mr. William Rigge's appreciated article in your last issue. The emersion occurred at $4^h\ 33^m\ 38^s.2$.

If it is convenient, will you convey our satisfaction to Mr. Rigge for his article and our anticipation of his next one?

Prescott, Arizona. LYLE ABBOTT.

GENERAL NOTES.

Dr. George E. Hale, director of the Mount Wilson Observatory, has been elected the twelfth representative of the international committee which, under the auspices of the League of Nations, is to study and suggest methods of intellectual co-operation throughout the world. He is the first American to be chosen for the committee.—(*Pub. Ast. Soc. of the Pacific,* Aug. 1922.)

Dr. W. Coblentz, associate physicist of the National Bureau of Standards, Washington, D. C., spent part of the month of June at the Lowell Observatory extending his radiometric investigations of last year at Flagstaff, on the stars and the planets. Remarkable results from these investigations were presented by Mr. E. C. Slipher at the September meeting of the American Astronomical Society, indicating that our views of the temperatures of the planets may be much revised. An abstract of the paper will appear in a later number of POPULAR ASTRONOMY, in the report of the 28th meeting of the Astronomical Society.

Dr. C. H. Gingrich, who has been spending a sabbatical year in study and research at the Mount Wilson Observatory, has returned to his post as professor of mathematics and astronomy at Carleton College and associate editor of POPULAR ASTRONOMY. During the summer term he taught mathematics and astronomy in the University of Chicago.

Mr. J. A. Pearce, assistant in the department of astronomy at the University of Toronto for the last two years has been appointed to a fellowship at the Lick Observatory, beginning his duties on July 1.

Mr. C. M. Huffer, who for the past five years has been at the Chile Station of the Lick Observotory, has returned to this country and has taken the position of assistant in the Washburn Observatory, Madison, Wisconsin.

Dr. Pio Emanuelli of Rome has been appointed assistant Professor of Astronomy in the Royal University of Rome.

Mr. Paul Bruck, director of the Observatory of Besançon, died on July 31, 1922. He had been connected with the Observatory at Besançon from 1884 to 1922.

Rev. Allen W. Quimby, a member of the American Astronomical Society from its foundation, died at Berwyn, Pennsylvania, on Sept. 23. He was pastor of various parishes of the Methodist Episcopal Church in Pennsylvania during the years 1878-1922. He was much interested in astronomy and was an assiduous observer of sunspots, the results of his observations being frequently published in the "Astronomical Journal."

Summer Workers at the Mt. Wilson Observatory.—In addition to the regular staff the following persons took part in astronomical or physical observations at the Mt. Wilson Observatory during the summer months: Prof. A. A. Michelson, Research Associate; Prof. C. G. Abbot and Mr. L. B. Aldrich of the Smithsonian Astrophysical Observatory; Dr. J. C. Duncan, director of the Whitin Observatory, Wellesley College; Dr. Knut Lundmark, instructor of astronomy in the University of Upsala, Sweden.

News from Yerkes Observatory.

The folowing evening lectures have been given at the Yerkes Observatory:

July 17—Mr. Lee: Report on astronomical meetings at Rome and elsewhere.
July 24—Mr. Van Biesbroeck: Recent aspects of double star observations.
July 31—Mr. Frost: Revelations of the spectroscope.
August 8—Mr. Parkhurst: Correlations between absolute magnitudes of stars and other data.
August 14—Mr. Barnard: Dark markings in the Milky Way.
August 21—Mr. Mitchell: Solar eclipses.
August 28—Miss Bigelow: Other watchers of the sky.
September 4—Symposium on stellar parallax.
September 15—Dr. Silberstein: Topics of current interest in astronomical physics.

Dr. Harriet W. Bigelow, Professor of Astronomy at Smith College, spent the spring and summer quarters at the Observatory in work in various departments.

Dr. Alice H. Farnsworth, of Mt. Holyoke College, was volunteer research assistant during the summer quarter.

Graduate students who spent one or both terms of the summer quarter at the Observatory were Prof. K. B. Patterson, of Trinity College, Durham, N. C., working in practical astronomy; Messrs. C. T. Elvey, of the University of Kansas, and L. R. Wylie of Northwestern University, working in stellar spectroscopy.

Other visitors who spent some weeks at the Observatory were: Professor S. A. Mitchell, of the University of Virginia; Professor F. E. Carr, of Oberlin

College; Professor C. C. Crump, of Ohio-Wesleyan University; Professor Philip Fox, of Northwestern University; Mr. Carl L. Stearns and Miss Ida Barney, of Yale University; Mr. H. C. Levinson, who received his degree of Doctor of Philosophy in theoretical astronomy at the September convocation of the University of Chicago; Dr. L. Silberstein, of the Research Laboratory of the Eastman Kodak Company; and Dr. Harriet McW. Parsons, of Smith College.

The Frye Observatory at Seattle, Washington.—In Circular No. 1 of the Frye Observatory Mr. T. S. H. Shearman states that the speculum and testing-plane for the 10-foot reflector "were successfully cast in my private workshop during the winter of 1921-1922. The delicate task of figuring and testing is now in progress. When completed, it will be conveyed to Seattle by water, and very special precautions will be taken to guard against possible accident during the journey. Two mountings will be provided. During visitors' hours the telescope will be used in a horizontal position, but when employed in photographing nebulae or other faint objects, it will point directly at the sky. Descriptions of these mountings will be given shortly. The very heavy castings used in this work will be made at the Wallace Foundry in Vancouver, and the structural steel work will be constructed in the Wallace Shipyards.

"Immediately after completing the final arrangements for the erection of the telescope, Mr. and Mrs. Frye left on a trip to Europe. Mr. Frye is deeply interested in art matters, and is a frequent visitor to the art centers of London, Paris, Berlin, and other cities. He has a well-selected collection of paintings made by the best artists in Europe and America. Following his artistic bent, it is his intention to make the Frye Observatory exceedingly ornate and beautiful in design. Art treasures will adorn its walls, and an unrivalled collection of the masterpieces of astronomical photography will reveal to the visiting public the glories of the starry heavens.

"Mr. and Mrs. Frye again visited Europe early in the present year, and when they return in the course of a few weeks, the exact location of the observatory in Seattle will be arranged. In the meantime the work of figuring the 10-foot speculum is going on, and I expect to make the first observation with it during the present month."

The Circular is dated July, 1922.

The Solar Eclipse of September 20, 1922.—It is too early as we go to press to have any definite reports from the Solar Eclipse, but from the daily press we have the information that the Lick Expedition to Wollal, Australia, had good weather and that the observations of the eclipse were highly successful. The return of the astronomical party to America is not expected until November.

Parallaxes of the Stars.—The results of the systematic campaign entered upon by several observatories to determine the parallaxes of the stars have been showing up very satisfactorily. Four lists have appeared in the *Astronomical Journal* during this summer giving accurate parallaxes determined from the measurement of photographic plates: 60 stars at the Allegheny Observatory, by Keivin Burns; 102 stars at the McCormick Observatory, by S. A. Mitchell and others; 46 stars at the McCormick Observatory, by Harold L. Alden; 76 stars

at the Sproul Observatory, by John A. Miller and John H. Pitman. Each of these lists is a continuation of former lists by the same observatories, and the accuracy of all is practically the same, the probable error of the determination of a parallax being about $\pm 0''.01$.

Wm. Gaertner & Co. have recently issued a new edition of the catalogue of astronomical instruments which the firm makes. This includes telescopes, with portable or fixed mountings, up to 12 inches aperture, transits, micrometers, chronographs, spectroscopes, comparators, globes, etc. The catalogue is gotten up in excellent form. The address of the firm will be found on our advertising pages.

Saturn's Axis. — Very recently some visitors were being shown the planet Saturn through a small telescope. As is well known, the rings in 1921 were turned edgewise to the earth and could not be seen at all. They are still very narrow, though they can be seen without difficulty. A lady on seeing the planet remarked, "Oh! Saturn ha san axis."—(*Jour. Roy. Astr. Soc. of Canada*, July-August 1922.)

Watchers of the Sky (The Torch-Bearers) by Alfred Noyes. F. A. Stokes, Pub. 281 pages. New York, 1922.

England has her poets and her scientists, she also has her nature poets, such as Wordsworth and Tennyson—but there has come to her a scientific poet (a poetic-scientist) in her "Alfred Noyes."

Poets of all ages have sung, dreamed and philosophized upon the stars and the harmony and beauty of the evening skies. The astronomical lore in Chaucer is well known. Milton's "Paradise Lost," too, carries with it the story of the visit of Galileo and the first telescope. Lesser poets have dwelt among the stars, and have told their stories in single verse and complete poems. But never as yet, have the lofty flights of the poets' dreams transcended the whole realm of the cosmic universe—and carried with them part of human history.

Noyes evinces a knowledge of the science of astronomy and its history that is complete and most interesting. To the reviewer, this seems remarkable in one who is so entirely unrelated to the work of an observatory. One is almost ready to believe that Noyes is an astronomer, by avocation at least. He has acquired a more intimate knowledge of Pythagorean doctrines, the "music of the spheres," than most moderns ever conceived attainable. However, be this as it may, his book is truly wonderful, charming and entertaining. To the layman it will no doubt appeal, for its beauty and the music of its narrative verse, broken and interspersed with epic poetry. But it remains for the astronomer and other scholars in science to enjoy it to the fullness which is adequate to Noyes' ability as a poet.

The poet has paid a wonderful tribute to the heroes and martyrs of the past—and honor to those of the present.

"This book, while it is complete in itself, is also the first of a trilogy, the scope of which is suggested in the prologue. The story of scientific discovery has its own epic unity—a unity of purpose and endeavor—the single torch passing from hand to hand through centuries; and the great movements of science, when, after long labour, the pioneers saw their accumulated facts falling into significant order—sometimes in the form of a law that revolutionized the whole

world of thought—have an intense human interest and belong essentially to the creative imagination of poetry. It is with these movements that my poem is chiefly concerned, not with any impossible attempt to cover the whole field as to make a new epic system, after the Lucretian mode, out of modern science" (Noyes in Prefatory Notes).

As he further states, the theme had been in his mind for many years, but the desire to give it expression became constantly more insistent, until the climax came upon that "unforgettable night," when the 100-inch reflecting telescope at Mt. Wilson Observatory was first tested by star light.

The prologue gives Noyes' detailed experience of that night. His journey up to the mountain's top, the observatory, the monastery, telescopes and mirrors, clockwork, switchboard, the lighted city below, planets and stars, atoms and electrons all are woven into that beautiful narrative poetry. It seems almost incredible that technical terms and concepts could lend themselves for that purpose.

The lives of all of the great epoch making astronomers are given in verse, their struggles, romances, successes and finally the passing of the torch, the results of their labour. And thus the word is passed in the final lines of this prologue.

> "Take thou the splendour; carry it out of sight
> Into the great new age I must not know,
> Into the great realm I must not tread."

In this we find the meaning of the torch as it is carried by each succeeding astronomer of old, to his successor.

The first poem "Copernicus" is concerned principally with the revolution brought by his overturning the old Ptolemaic system, and the dramatic death-scene of Copernicus, and his last great desire to lay his hands upon the book "De Orbium Coelestium Revolutionibus" just being printed. This is the beginning of the history of modern astronomy, 1543.

The torch is passed to Tycho Brahe, the Danish astronomer at Uraniburg.

This second poem shows the state of astronomy a century later and Brahe's desire to bring it out of the realm of mystical thought. With this is interwoven the romance of the Danish nobleman and the "flaxon-haired" peasant girl. In fact, all through the poem, through Brahe's failure, success and final reward, his Christine makes him happy. His catalogue of the exact position of 700 stars, determined at Uraniburg, laid the needed foundation for astronomical advance. His soul's desire was to complete this to 1000 stars. But misfortune overtook him and he was obliged to leave. Through Germany and Austria he wandered and finally at the court of Rudolph he settled. Here came Johann Kepler, also a wandering emissary of science. In his final words to Kepler, Brahe says—

> "Come then, swift-footed, let me see you stand
> Waiting before me, crowned with youth and joy;
> This is the turning, take it from my hand.
> For I am ready, ready now to fall."

In Kepler, again, we have the 17th century domestic life portrayed—but the principal parts of the poems carry forward the three great laws in celestial mechanics. In themselves they are not mechanics, but the fundamentals of the "harmony of the sphere." Kepler's immortal contribution to the advance of astronomy consisted in the discovery of the laws of celestial motion, deduced from Brahe's great mass of systematic observations.

The poem which seems to have more of the dramatic setting and color,

and possibly to be the most interesting from the point of view of historical importance, is "Galileo." In this the dramatic dialogue centers about the Inquisition. The poem opens with the pathetic appeal of Galileo's daughter Celeste, a nun in the Convent at Arcetri, who writes to her old lover at Rome.

In the fourth part, Celeste writes to her father in his imprisonment at Siena. She remains devoted and loyal to her death, which is described pathetically by Galileo after his return to Arcetri, in part five of the book. Galileo is now virtually a prisoner in his own home, and in part six (the last of this dramatic poem), a disciple of his, Viviani, many years later, writes to a friend in England. The principal theme of this part is the visit of Milton to Galileo.

The torch is now carried into the great new age of astronomy to Newton—the greatest of them all. Although he says

> "If I saw farther, 'twas because I stood
> On giant shoulders."

Here we have in successive poetic order the great discoveries of Newton. His analysis of light by the prism into a spectrum; the principle of the reflecting telescope; the fundamental law of the physical universe—Gravitation, and finally his fluxion theory, known as the calculus. Following this comes the great "Principia," and the germ of the now famous theory of Relativity.

In the light of imagination the author emphasizes the spiritual elements of Newton's life, faith and love—

> "Until we come to that First Cause of all.
> The Power, above, beyond the blind machine,
> The Primal Power, the originating Power,
> Which cannot be mechanical. He affirmed it
> With absolute certainty. Whence arises all
> This order, this unbroken chain of law,
> This human will, this death defying love?
> Whence, but from some divine transcendent Power,
> Not less, but infinitely more than these,
> Because it is their Fountain and their Guide."

The last poem upon our heroes is on William Herschel, the German music master, who became a great English astronomer. In this poem the torch is carried in a triple combination from brother to sister to the son of brother William. At the end each member of the solar system, from the sun to the farthest planet Neptune, sings its song of praise.

Noyes has however overlooked the fact that the planet Mercury belongs to the solar system—as no mention is made of it.

In the epilogue Noyes meditates once more upon the mountain in the morning and brings his story to close in the form of a prayer.

The very poetry of mathematics, and especially of astronomy as set to music, is certainly by Noyes a test for genius. In Kepler's three laws, Newton's laws and Herschel, by the music of mathematics would build the heavenly city. As an after-thought the question might be asked, does the poet respond to great movements in science as he does to other phases of human life—particularly to the elements of war? Astronomy is at its highest development and interpretation today. The poems are beautifully conceived, tell accurately the story of each great astronomer, his life and work and the message to be carried on.

In the whole history of science none bears witness to pathos of struggle and the heroic lives of its devotees as does Astronomy. And on this Noyes has placed due emphasis.

These poems cannot very satisfactorily be read separately. Each depends upon the other—for the beauty is in the whole and not in the parts. One must know fairly well the story of the evening sky, and the struggle of the human mind from the Rennaissance to the present, to fully catch the spirit of Noyes and the "Watchers of the Sky."

For the book is true to subject and true to history.

FREDERICK E. BRASCH.

National Research Council,
Washington, D. C.

A New Illustration.—One thousand sheets of ordinary book paper laid flat on one another piled up to the height of three inches; one million such sheets would reach a height of 250 feet and one billion sheets nearly 47½ miles, more than 8½ times the elevation of Mount Everett above sea level.

D. F. BROCCHI.

Chart Distances between the Pleiades.—The following table of distances between the stars of the Pleiades was inadvertently omitted from Mr. D. F. Brocchi's article on "Variable Star Observing" in the August-September number of POPULAR ASTRONOMY. It should have been printed below the diagrams on page 418.

	′		′		′		′		′
ab	10.7	bl	59.9	dk	38.3	fn	73.1	in	26.2
ac	33.6	bm	64.2	dl	58.5	fo	70.3	io	34.5
ad	12.2	bn	71.6	dm	57.6	fp	77.2	ip	48.1
ae	14.8	bo	72.2	dn	77.1	gh	18.8	jk	12.2
af	22.2	bp	83.6	do	75.3	gi	42.2	jl	17.0
ag	29.4	cd	22.5	dp	83.8	gj	36.8	jm	32.1
ah	38.7	ce	28.8	ef	11.3	gk	39.7	jn	13.8
ai	71.4	cf	20.0	eg	26.2	gl	41.4	jo	14.3
aj	62.2	cg	55.9	eh	28.0	gm	49.7	jp	27.6
ak	61.9	ch	54.4	ei	66.8	gn	49.3	kl	5.2
al	61.2	ci	95.8	ej	52.8	go	50.8	km	19.7
am	63.5	cj	78.8	ek	49.9	gp	63.2	kn	22.0
an	76.4	ck*	72.5	el	48.5	hi	42.8	ko	16.6
ao	76.4	cl	69.7	em	49.0	hj	25.1	kp	24.4
ap	86.2	cm	64.1	en	66.8	hk	23.6	lm	14.9
bc	44.2	cn	92.2	eo	65.3	hl	23.7	ln	26.6
bd	21.9	co	89.2	ep	73.8	hm	30.9	lo	20.2
be	20.4	cp	94.6	fg	37.0	hn	39.0	lp	25.5
bf	30.5	de	10.4	fh	34.6	ho	37.8	mn	40.5
bg	22.3	df	11.1	fi	76.2	hp	47.6	mo	33.1
bh	36.0	dg	34.7	fj	59.4	ij	27.7	mp	32.6
bi	63.5	dh	38.1	fk	53.9	ik	39.8	no	8.9
bj	58.6	di	76.4	fl	51.8	il	44.6	np	22.0
bk	59.5	dj	63.5	fm	48.7	im	59.8	op	14.2

*Calculated for 1900. Other distances scaled on photograph.

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